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Improving the formation of virtual enterprises through a systematic approach for managing key broker activities

John Yancey Easley

IMPROVING THE FORMATION OF VIRTUAL ENTERPRISES THROUGH A

SYSTEMATIC APPROACH FOR MANAGING KEY

BROKER ACTIVITIES

By

John Yancey Easley

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Virtual enterprises are increasingly being used as an organizational strategy for meeting customer needs. Potential benefits of virtual enterprises include increased profits, flexibility, increased customer service, better quality, a quicker time to market, and access to larger markets. However, the brokers that organize these ventures face challenges that arise in five key management activities: select partners, develop communication, develop culture, develop trust, and enhance behavior through motivation. A broker's ability to overcome the problems in these activities determines the degree to which the benefits are achieved. Examples in the literature point to the possibility that interactive relationships exist between the five management activities. Considering all of these possible associations leads to a complex web of relationships that makes it difficult to determine the overall impact of specific improvements.

This research investigates the five management activities and defines the primary relationships between them. The primary relationships are used to develop a conceptual model that brokers can apply as a methodology for systematically developing a virtual enterprise and thereby proactively addressing potential problems.

In developing the conceptual model, this research utilizes approaches from other disciplines for addressing similar problems. The application of these approaches results in the use of systems engineering concepts to plan and design a virtual enterprise, the development of a partner selection methodology that incorporates ideas from the supplier performance measurement literature, the development of a pre-partner cultural assessment and post-partner cultural development process that are based on ideas found in the literature on mergers, and the use of project management as a means for coordinating the activities in a virtual enterprise.

In addition to the preceding contributions, this research provides a comprehensive view of the characteristics of virtual enterprises. Included in these provisions are a detailed definition process and an extension of the literature to establish a typology of virtual enterprises.

DEDICATION

I would like to dedicate this research to my family for their continual support, encouragement, and prayers. I would especially like to thank my immediate family:

Mama and Daddy
My brother Patrick, his wife Jill, and the two little ones on the way!
My beautiful, sweet, and lovely wife Marianna

Thank you, Marianna, for your countless proof readings of my dissertation. Without your selflessness, this would not have been possible.

Finally, I want to communicate a deep gratitude to my grandparents and great grandparents who were a major source of encouragement during the doctoral process. I am sorry that I was unable to complete this research in time for everyone to enjoy the moment with me.

Granny
Bren

In memory of: Big Mama – September 27, 2002
       Mamaw – October 29, 2003
       Baba – December 1, 2004

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Any others whom I have failed to mention (not on purpose), thanks for all the continued support.

Finally, I thank God and Christ Jesus for the blessings and opportunities that continue to characterize my life. Through good times and bad, He has and will always be there for me (Hebrews 13:5). I pray that you trust Him as well (John 3:16, I Corinthians 15:1-4).

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CHAPTER I

INTRODUCTION

A vertically integrated organization is described by Nicholas Mitsos [1998] as "a business that owns the means for production, from the mining of raw materials to manufacturing through distribution and servicing." An example of a vertically integrated organization is Henry Ford's early twentieth century River Rouge plant. It took in the necessary raw materials as inputs and then transformed the raw materials into an automobile. Indeed, Ford realized an objective that many companies would like to attain – self-sufficiency. [Hammer, 2000]

However, problems could arise because of self-sufficiency. The most obvious reason is that self-sufficiency requires spreading out resources in order to accomplish all of the necessary tasks. Because resources are widely distributed, the ability to be outstanding in performing a few processes is sacrificed in order to be less than best on a large number of processes. While companies in the past may have survived while performing less than best in certain stages of their processes, this practice is often not adequate in today's environment. With ever increasing customer demands, the result of second-rate performance could mean failure to survive. To cope with this situation, many companies are turning to virtual integration through virtual enterprises.

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A virtual enterprise is defined as "a network or loose coalition of manufacturing and administrative services using integrated computer and communication technologies to link differing groups of personnel for a specific business purpose, disassembling when the purpose has been met." [F. Wilson, 1999] The whole basis behind the development of a virtual organization is for a company to identify its core competencies, concentrate on them, and outsource the other stages in the value chain to companies with those type processes as their core competencies. An example from the sporting world is the original basketball Dream Team at the 1992 Olympics in Barcelona, Spain. This team was made up of players from various teams in the National Basketball Association, with the exception of one college player. While each NBA team has high quality players at each position, no single NBA team has the best player at each position, as the Dream Team did. By temporarily coming together to accomplish a specific objective (i.e., win an Olympic gold medal in basketball for the United States), the Dream Team represents what is becoming an increasing phenomenon in today's business world…the virtual enterprise.

1.1. Statement of the Problems

Virtual enterprises are continually rising in popularity as an organizational strategy for meeting changing customer needs in a more global market. To reap the benefits promised by virtual enterprises, however, brokers must develop better approaches for addressing the key problems that arise in the virtual structures. The literature highlights five management activities – select partners, develop communication, develop culture, develop trust, and enhance behavior through motivation – where key problems arise.

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Due to the temporary nature of virtual enterprises, approaches that simply address problems as they arise may result in little to no significantly beneficial outcome. Therefore, a need exists to develop a systematic approach for properly developing a virtual enterprise and thereby proactively addressing potential problems.

1.2. Objectives

The primary objective of this research is to develop a methodology for properly developing a virtual enterprise. In order to develop the methodology, each of the five key management activities where problems arise is investigated. The investigation focuses on identifying the primary relationships that exist between the management activities. A proper understanding of the primary relationships provides the foundation necessary to systematically develop a methodology that proactively addresses the key problems of virtual enterprises.

To define the primary relationships and develop the methodology, two other objectives must be accomplished. First, the research provides a more in-depth understanding of the characteristics of virtual enterprises than is currently available. A deeper understanding allows for a more detailed definition process of a virtual enterprise as well as a typology of the different types of virtual enterprises. Next, this research incorporates ideas from other disciplines into the methodology. For example, the development of a partner selection methodology that incorporates ideas from the supplier performance measurement literature, the use of systems engineering for systematically planning and designing a virtual enterprise, the development of a pre-partner cultural

assessment and post-partner cultural development process that are based on ideas found in the literature on mergers, and the use of project management as a means for coordinating the activities in a virtual enterprise.

CHAPTER II

LITERATURE REVIEW

The amount of literature available on virtual enterprises continues to grow as the structure's popularity increases. Despite the sources currently available, it is still difficult to fully understand the virtual enterprise concept. This chapter merges the widespread information currently available on virtual enterprises and provides the reader with a more comprehensive view of the major characteristics of virtual enterprises. Beyond the provisions of this chapter, Chapter 3 is used to extend the literature and provide a more detailed definition of a virtual enterprise and develop a categorization of the types of virtual enterprises.

2.1. Why Virtual Enterprises?

Organizational theorists state that businesses will have to change their organizational designs to be more competitive in the twenty-first century. [Fitzpatrick and Burke, 2000] To achieve this change, many authors cite the need for a move to a virtual organizational structure. [Fitzpatrick and Burke, 2000] This structure can be seen as a [1]holarchy because it is a temporary aggregation of individual enterprises created to pursue specific

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[1] A holarchy is a stucture of holons, which are autonomous and co-operative building blocks of a manufacturing system for transporting, transforming, and storing information and material. They are organized to achieve a production goal.

business objectives, each remaining alive as long as the objective is pursued. [Mezgar and Kovacs, 1999]

According to Bleecker [1994], four main factors drive the movement towards virtual enterprises. These include: the quick pace at which businesses now run, the lower cost of market entry than in the past, the ever-growing personalization of products for customers due to computerized manufacturing capabilities, and the international realm in which businesses currently compete.

Advancing information and communication technologies, increased competition, and the opportunities for new strategies (created by the previous factors) are also driving factors for virtual organizations. [Cooper and Muench, 2000] Franke [1999] concurs by saying that the two main forces inspiring the move to a virtual structure are: 1) changing market conditions and customer needs and 2) the development of information and communication technology.

Bloch and Pigneur [1995], in Choi and Bae [2001], identify three primary factors they feel are the driving force behind virtual enterprises: an increased focus on core competencies, an increased need for partnering due to levels of complexity in the life-cycle engineering of some product areas, and a need for more agile systems as the result of market forces. The result is that the product life cycle is shortened.

Eschenbacher, Kuck, and Weiser [2001] state that enterprises form a temporary network because of such incentives as cost and risk reduction, knowledge transfer, and the reduction of time to market.

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Eschenbacher [1999] and Eschenbacher, et al. [2001] credit an increasing focus on virtual enterprises to cost pressures, a fast globalization process of the economy, new information and communication technologies resulting in an industrial revolution, and structural changes.

The references above indicate key drivers for the movement toward virtual enterprises. Table 2.1 provides a summary of the key driving factors for virtual enterprises and the corresponding cited sources.

Table 2.1: Why Virtual Enterprises are Needed

	Bleeker, 1994	Bloch and Pigneur, 1995 in Choi and Bae, 2001	Cooper and Muench, 2000	Eschenbacher, 1999 in Eschenbacher, et al, 2001	Eschenbacher, et al, 2001	Franke, 1999
Changing market/quick pace	x	x	x	x	x	x
Cost incentives	x			x	x	
Increased competition/globalization	x		x	x		
Development of Information Technology			x	x		x

2.2. The Genesis of Virtual Enterprises

While no one can specifically point to the exact time the first virtual organization came into being, the concept has its roots in outsourcing strategy and the growth of information technology. Gil-Estallo, et al. [2000] state that Davidow and Malone

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[Davidow and Malone, #2, 1993] first introduced the term "virtual corporation" describing a market-oriented company that can give immediate answers to customer demands. Pihkalo, Varamaki, and Vesalainen [1999] point to Piore and Sabel [1984] who identified steps toward organizing what was "hardly a company at all." [Wilson and Dobrzynski, 1986]. According to Franke [1999], other terms created to describe this structure include virtual organization [Moshowitz, 1986], virtual company [Goldman and Nagel, 1993], virtual enterprise [Hardwick, et al., 1996], and virtual factory [Upton and McAfee, 1996].

Although these early ideas deserve recognition, there is one source that may provide the first vision toward what the virtual enterprise would entail. In 1984, Miles and Snow described a new organizational form of the future. Their ideas emerged partially due to the outsourcing practices of construction companies. In addition to the construction industry, their background for this type of structure came from two other types of companies. One was that of a global consumer goods company that sells standardized products. To achieve this, the organization bought materials where they were the cheapest, manufactured where it was the cheapest, and sold the products where the prices were highest. The other type of organization to which they referred was electronic and computer firms who dealt with rapid change and high tech products. Based on the combination of these ideas, they theorized a new type of organizational form. The organization would be vertically disaggregated, with its functions brought together by brokers and held in temporary alignment by a variety of market mechanisms. They

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referred to this theoretical form as the "dynamic network organization", believing that the only obstruction to its manifestation was the absence of a core activating and control mechanism. They theorized the control mechanism to be that of a broad access computerized information system.

2.3. Common High-Level Components Among Virtual Enterprises

Certain high-level components are associated with most virtual enterprises. Formal identification and brief explanations of these characteristics are provided below.

2.3.1. Core Competencies

"Core competencies are the two or three most tangible, value-added activities that distinguish one company from its competitors and provide access to a variety of markets and opportunities." [Strader et.al., 1998, referring to Bottoms, 1994] It is this concentration on core competencies, when applied to the entire value chain, that allows products to be completed by a virtual organization instead of a single, static organization. That is, companies concentrate on processes, not products, and contract out those non-core activities to those organizations holding them as their core competencies. The network is then able to exploit individual advantages and expertise levels while sharing costs, skills, and resources. Therefore, new manufacturing and production possibilities transpire. [Lecompte, et al., 2000]

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2.3.2. Dynamic Supply Chains

While a value chain in a virtual organization is made up of member organizations concentrating on core competencies, the value chain itself is dynamic in nature. Individual members of the chain may be replaced at any time, or the chain itself may be completely dissolved. This characteristic itself, according to Pihkala, et al. [1999] is the strength of the network, and these alterations may be due to factors such as cost, speed, quality, change in product focus, or any other reason relevant to competitive advantage. This "dynamic network" idea was initially verbalized by Miles and Snow [1984, 1986] and allows for every bit of pricing to be wrung out of the manufacturing process. [Binstock, 2000] In addition to cost advantages, the ability to change partners allows the chain to theoretically become stronger through more adaptability, flexibility, and the ability for quick response to market changes. [Grabowski and Roberts, 1999]

2.3.3. Information/Internet and Communication Technologies

Information is a key aspect of virtual organizations [Gil-Estallo, et al., 2000], and the capability of virtual organizations becoming a reality is largely due to the ever-growing developments in information and communication technology and the Internet. In fact, information technology is often seen as the glue that ties the geographically distributed members together [Grabowski and Roberts, 1999]. De Sanctis and Monge [1999] explain this glue further by saying that virtual organization designs are literally held together by communication which "is fundamental to any form of organizing, but it is preeminent in

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virtual organizations." Strader, et al. [1998] concur by saying that without the integration and coordination capabilities of today's IT, organizations of the past were forced to vertically integrate in order to minimize information and external coordination costs. However, these integrated computer and communications technologies do exist, and using them will allow organizations to be increasingly "defined not by concrete walls or physical space, but by collaborative networks linking hundreds, thousands, even tens of thousands of people together." [Bleecker, 1994] The many linkage possibilities help facilitate communications at all levels of an organization; therefore, virtual organizations make heavy use of communication technologies in their business activities to help achieve objectives. [Gil-Estallo, et al., 2000]

2.3.4. Brokers or Strategic Control Centers

While the notion of a virtual organization itself does not assume a specific control center in the chain, most authors agree on their importance [Pihkala, et al., 1999]. Kanet and Faisst [1999] further explain the concept of brokers and say that a key element of the virtual enterprise model is the broker. Broker organizations assume the task of creating trust in the system and act as the central coordinator in the network of participants. They contain the necessary functions needed to allocate, coordinate, and manage member organizations from raw material acquisition to customer service. [Fitzpatrick and Burke, 2000---referring to Galbraith,1995; Dickerson, 1998; and Goldman, 1998] To perform this coordination role, brokers must quickly bring together a strategic group of

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participants each focused on accomplishing a common vision through the use of the resources and activities contributed by the virtual partners. Thus, information technology is a must.

2.4. Benefits of Virtual Enterprises

Benefits associated with virtual enterprises were identified from the literature that was reviewed (see Appendix A). From this list, each of the authors' stated benefits were considered in conjunction with one another in order to identify similarities and common themes (see Table 2.2). These themes were then used to consolidate the list. After consolidation, it can be shown that a majority of the benefits relate to the following five major areas: financial incentives, flexibility/adaptability incentives, customer service incentives, synergistic incentives, and globalization incentives. Table 2.3 identifies which of the various authors identified benefits within these major categories. It is important to note, however, that while an article does not explicitly state that something is a benefit, this may not mean that the author does not feel it is a benefit. For example, some authors may feel better customer service is implied. Therefore, they might not list this as a benefit, which means that it does not appear in Table 2.3.

Table 2.2: Compiled Benefits and Citations

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Benefit	Ansley, 2000	Bleecker, 1994	Cascio, 2000	Christie, et al. 1998	DeSanctis and Monge, 1999	Eschenbacher, et al. 2001	Fitzpatrick and Burke, 2000	Grabowski and Roberts, 1999	Mowshowitz, 1997	Snow et al. 1996 (in Jarvenpaa and Leidner, 1999)	Kemohan, 1999	Strader, et al. 1998
margins	x											
capital	x											
time-to-market	x	x		x							x	
quick geographic expansion	x										x	
flexibility	x			x	x	x	x	x			x	
specialization	x			x								
better products		x		x								
higher quality		x										
higher returns on bottom line		x	x	x								
leverage strengths of each member		x		x			x				x	
improve efficiencies		x		x								
reduce expenses		x	x			x	x		x			
focus on interoperability of processes and support systems		x										
increased productivity			x									
improved customer service		x	x	x							x	
access to global markets		x	x	x		x						x
environmental benefits			x									
greater adaptability					x			x				x
motivation					x							
respond quickly to market changes				x	x		x	x	x			
improved resource utilization									x			x
streamline the flow of goods and service to the consumer										x		
make more informed decisions										x		
agility												x
speed of a small company												x
concentrate on core competence				x								x
state of the art technologies						x						
liquidity						x						
coordination (networking/trust)					x							

Table 2.3: Consolidated Benefits and Citations

	Ansley, 2000	Bleecker, 1994	Cascio, 2000	Christie, et al, 1998	DeSanctis and Monge, 1999	Eschenbacher, et al, 2001	Fitzpatrick and Burke, 2000	Grabowski and Roberts, 1999	Mowshowitz 1997, Snow et al. 1996 (both in Jarvenpae and Leidner, 1999)	Kernohan, 1999	Strader, et al, 1998
Financial	x	x	x	x		x	x		x		
Flexibility/Adaptability	x	x		x	x	x	x	x	x	x	x
Customer Service		x	x	x					x	x	
Synergy	x		x	x	x	x	x		x	x	x
Expansion/Globalization	x	x	x		x		x			x	x

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2.4.1. Improved Customer Service

The goal of any company should be increased customer satisfaction. Without this, the ultimate goal of maximizing profit cannot be achieved. As the resources of the virtual organization increase due to multiple member organizations, the organization itself is able to extend its reach. Therefore, it is better able to respond with products in line with customer wants and desires. This leads to higher customer satisfaction and, eventually, higher profits. [Christie, et al., 1998] Better products, higher quality, responsiveness to customer needs, and more personalization of products are all examples of how virtual enterprises increase the level of service to the customer.

2.4.2. Financial Incentives

Higher profits, minimization of structural costs, lower production costs, and avoidance of excess fixed costs are all examples of the financial benefits attributed to virtual enterprises by various authors in the literature.

2.4.3. Flexibility/Adaptability

Having the cooperation of multiple independent organizations results in a wider array of talents and specialties. The ability to respond and adapt to ever-changing market conditions is increased because of this. In addition, the capability to increase or slow down production is often more efficient than in traditional organizations. [Ansley, 2000]

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2.4.4. Ability to Globalize

Companies can take advantage of opportunities in the global market by aligning themselves with organizations in the respective region or country. [Strader, et al., 1998] By networking with other independent organizations, virtual enterprises gain access to the distribution infrastructures of the partners and can quickly expand the geographic area to which the product market extends.

2.4.5. Synergy

Merriam Webster's dictionary [MWOD] defines synergy as "a mutually advantageous conjunction or compatibility of distinct business participants or elements (as resources or efforts)". The networking associated with virtual enterprises allows for these types of results to be seen as it leverages the strengths of its individual members. Improved resource utilization, competence bundling, a focus on core competencies, avoidance of asset inflexibility, and the ability to make more informed decisions are all examples of how networking with other organizations can boost efficiency and productivity and, in the end, result in the benefits discussed earlier.

2.5. Disadvantages of Virtual Enterprises

As with the benefits of a virtual enterprise, authors list various disadvantages. A literature search resulted in the disadvantages identified in Appendix B. This list was then compiled and consolidated in a manner similar to the benefits (see Table 2.4 and Table 2.5). As a result, it was found that a majority of the stated disadvantages fit into the following primary categories: costs, cultural issues, employee related issues, trust and control issues, and technological issues. It is interesting to note that in searching for references listing disadvantages, fewer articles were found. This is probably due to the fact that most articles are written to promote the advantages of virtual enterprises.

2.5.1. Costs

One of the primary concepts of the virtual structure is outsourcing. With outsourcing come costs that may or may not be highly visible. These include administrative costs such as situational analysis, requests for proposals, and other costs leading up to the actual awarding of a contract. [Garaventa and Tellefsen, 2001] In addition, transshipment costs are often increased due to the significant amount of outsourcing. Another consideration is that member organizations may need to adapt their compensation systems to address the new structures that are in place.

2.5.2. Trust and Control Issues

Virtual, as opposed to vertical, integration means that more and more control is given up over the value chain. Although the optimization of each part is theoretically attractive,

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Table 2.4: Compiled Disadvantages and Citations

Disadvantage	Cascio, 2000	Christie, et al., 1998	DeSanctis and Monge, 1999	Hardwick et al., 1996 (in Choi and Bae, 2001)	Eschenbacher, et al., 2001	Fitzpatrick and Burke, 2000	O'Hara-Devereaux and Johansen, 1994 (in Jarvanpaa and Leidner, 1999)	Mowshowitz, 1997 (in Jarvanpaa and Leidner, 1999)	Strader et al., 1998
setup and maintenance costs	x								
loss of cost efficiencies	x								
cultural issues	x	x		x					
feelings of isolation	x								
issues of trust	x	x							x
application systems cannot interoperate			x						
loss of control			x		x				x
insufficient security controls			x	x					
unfamiliar technologies and application systems			x						
greater conflict		x							
decreased firm loyalty		x				x			
higher probability of catastrophic events		x							
competence erosion					x				
infrastructural costs/ social costs					x				
overtaxing/costs for fluctuation					x				
motivation (security deficits, pseudo-self employed)					x				
legal diffusion barriers of internet					x				
contractual stipulations and disturbances					x				
low individual commitment							x		
role overload							x		
role ambiguity							x		
absenteeism							x		
social loafing							x		
lack of permanency								x	
lack of reliability								x	
lack of consistency								x	
must manage beyond own walls									x
must coordinate business processes, personnel, and information systems									x
partner access to company information		x				x			
new type of worker needed		x							
communication issues		x	x						
transhipment costs						x			

Table 2.5: Consolidated Disadvantages and Citations

	Cascio, 2000	Christie, et al, 1998	DeSanctis and Monge, 1999	Hardwick et al, 1996 (in Choi and Bae, 2001)	Eschenbacher, et al, 2001	Fitzpatrick and Burke, 2000	O'hara-Devereaux and Johansen, 1994 (in Jarvanpaa and Leidner, 1999)	Mowshowitz, 1997 (in Jarvanpaa and Leidner, 1999)	Strader et al, 1998
Costs	x				x	x		x	
Cultural Issues	x	x			x				
Employee Issues	x	x	x		x	x	x	x	x
Trust and Control Issues	x	x	x	x	x	x		x	x
Technological Issues		x		x	x				x

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this does not necessarily mean that the overall system is optimized. Introducing more external interfaces results in more complex coordination activities. [Strader et al., 1998] For example, subdividing goals into tasks, assigning tasks to groups or individuals, allocating resources, sharing information, and combining the different preferences and knowledge of the individuals in order to achieve overall goals are all potential coordination problems. [Franke, 1999] In addition to coordination problems, the sharing of proprietary information and technology may result in innumerable problems if the information ends up in the hands of an untrustworthy organization. [Strader, et al., 1998]

2.5.3. Employee Related Issues

Because there is no static organizational structure, it is highly possible that employees of the member organizations hold lower levels of loyalty than they might normally possess in a traditional organization. This leads to problems in terms of motivation, decreased organizational participation, and competence erosion. Another problem with the new type of structure is that managers must learn to manage beyond the walls of their own organization. Often this means that new types of roles are required, including a decreased emphasis on power and authority. Also, performance and evaluation plans may need to be adapted to fit the new organizational structure.

2.5.4. Cultural Issues

The cooperation of various organizations brings with it the representation of various cultures, which are potential obstacles [Christie, et al., 1998]. This could result in

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communication problems, conflicting value systems, and other perception related problems.

2.5.5. Technological Issues

As technology continually improves, the opportunities provided also increase. However, there is also the opportunity for new challenges to arise because of issues such as unfamiliarity. These types of problems could eventually lead to difficulties in effective utilization. [Cooper and Muench, 2000] In addition, the exchange of documents between member organizations depends on the fact that those participating have a common format. As links in the chain alter, it is highly possible that everyone will not have a consistent format.

2.6. The Life Cycle of a Virtual Enterprise

Certain distinct phases emerge as a virtual enterprise progresses. Strader, et al. [1998] classified these as the identification, formation, operation, and termination phases. A summary of the activities in each of these phases may be seen in Table 2.6.

While Strader, et al. [1998] summarized the virtual enterprise life cycle in four phases, Kanet and Faisst [1999] present a slightly different arrangement. The major difference is that the design aspect of the operation phase is separated into a distinct phase.

Table 2.6: The Life Cycle of a Virtual Enterprise

Phase I: Identification
Identify Opportunities
Evaluate Opportunities
Select Most Viable Opportunity
Phase II: Formation
Identification of Potential Partners
Evaluation of Potential Partners
Selection of Potential Partners
Formation of Virtual Enterprise
Phase III: Operation
Design
Marketing
Financial Management
Manufacturing
Distribution
Phase IV: Termination
Terminate Operations
Disperse Assets

2.7. Factors Contributing to the Success of the Virtual Enterprise

According to Pihkala, et al. [1999] previous knowledge for management of a virtual

network is sparse. The reason for this may be that the management of a virtual enterprise

is a task that is variable by nature. Because of this variable nature, no static foundation of

components has been laid for the proper management of virtual enterprises. However,

some general ideas have been put forth on this subject. According to Gil-Estallo, et al.

[2000] there are three main pillars needed in order for a virtual enterprise to function

properly: virtual organizations must be flexible enough to allow the quick acquisition or

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generation of knowledge and the ability to change rapidly, there must be fluid communication within the virtual enterprise and with the surrounding environment, and the facilitation of flexibility and fluid communication is done through applying virtuality in all activities.

Pihkala et al. [1999] add that all members should share similar feelings on the business aspects of the organization. In addition, they contend that trust is an essential element to properly maintain the virtual enterprise. However, the continually changing nature of virtual enterprises results in a different type of trust than is typically considered. Instead of the ability to build a trusting relationship over the course of time, the organizations that collaborate in the venture may not even know each other prior to membership. Because of this, the trustworthiness of the member organizations is often reflected through the broker. The critical nature of this representation of trust is compounded because of the confidential types of information shared among the virtual value chain. Thus, it is important that brokers develop reputations for assembling trustworthy member organizations.

Other management ideas are put forth in Markus, Manville, and Agres [2000]. In this article, they investigate the question of "Why Virtual Organizations Work?" The answer was found from a study on the open-source software movement. It was hypothesized that key insights could be gained from the study of the open-source movement, since it is much like virtual enterprises. From the study, certain key principles resulted. One of the findings was that the idea of self-governance plays a key role. This concept includes the

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ability for membership to be managed; rules and institutions to be adapted to the members' needs; reputation being used as a motivator and control mechanism; and shared cultures, values, and norms among members. The remaining principles for success are based on the fact that:

- those contributing share a powerful set of motivating forces, including a share in success.

- there is a need to have effective work structures and processes.

- the technology for communication and coordination is present as are the norms about its use

Christie, et al. [1998] identify nine factors, based on the analysis of successful and unsuccessful virtual organizations, which contribute significantly to successful virtual organizations. They are: focus on customer needs, choice of right partners with proper core competency, win-win outcome for all participating organizations, trust, communication (and the power of information), protection of company's proprietary information, a new kind of organizational structure (lean and flexible), the need for a new breed of leader (facilitator and supporter rather than dictator of orders), and the need for a new breed of worker (highly motivated, self-directed, educated, highly skilled, reliable).

Strader, et al. [1998] provide one of the more comprehensive sets of management requirements. They introduce several management mechanisms, each of which falls in one of three categories. The categories include pre-formation mechanisms (actions necessary leading up to actual formation of the organization), external access

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mechanisms (gathering data, operational advertising, and transaction support), and inter-organizational coordination mechanisms (integration, coordination, and support among the members). From this, the authors identify six components that support each of the mechanisms, most of which revolve around the electronic access and coordination made possible by today's information technology. These components include a global information network, electronic access to external data, electronic connections between partners, electronic access to operational data, intra-organizational information system support, and electronic connections to customers.

2.8. Virtual Enterprises and Organizational Size

A virtual structure of organization is advantageous. The concept is still growing, however, and future opportunities abound for traditional organizations to take advantage of the concept. This includes both small and medium size enterprises as well as large organizations.

Recent history shows that large organizations are not immune to problems simply because of their size. MCI WorldCom and Enron are two recent examples of how mega-companies can succumb to certain situations. The Dow Jones Industrial Average (DJIA) provides another look into just how vulnerable any organization is. The Dow is a widely used and very popular gauge of the stock market in the United States. It currently consists of thirty highly traded stocks on the New York Stock Exchange. According to the Dow Jones Industrial Average web page [www.dowjones.com], "while there are no

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rules for component selection, a stock typically is added only if it has an excellent reputation, demonstrates sustained growth, is of interest to a large number of investors and accurately represents the sector(s) covered by the average." Using deductive reasoning, a company that falls from the list does not meet these characteristics and has not adapted to the changing needs of the market.

Tables 2.7, 2.8, 2.9, and 2.10 provide lists of the companies included in the DJIA as of fifty years ago (i.e., December of 1954), twenty-five years ago (i.e., December of 1979), ten years ago (i.e., December of 1994), and those currently included (i.e., December of 2004). [www.dowjones.com] Table 2.11 identifies the current companies that were also included fifty, twenty-five, and ten years ago.

These tables provide an excellent picture of the need for all businesses to consider the advantages provided through virtual partnerships. Specifically, these tables demonstrate the vulnerability of large organizations that do not adjust to the ever-changing market needs. Large organizations typically possess the knowledge and resources to respond to market opportunities. A hindrance is that they are naturally slow in terms of change and response. Virtual enterprises provide large organizations with a unique opportunity to quickly network with other organizations and rapidly respond to the environment.

Small and medium enterprises (SMEs), alternatively, lack the knowledge and funds that are necessary to exploit market opportunities. This is especially true on a large scale. Virtual organizations create an environment where SMEs are able to pool resources and effectively respond to changes in the market.

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Table 2.7: Companies in the Dow Jones Industrial Average (December of 1954)

Allied Chemical	General Electric Company	Proctor & Gamble Company
American Can	General Foods	Sears Roebuck & Company
American Smelting	General Motors Corporation	Standard Oil of California
American Telephone & Telegraph	Goodyear	Standard Oil (NJ)
American Tobacco B	International Harvestor	Texas Company
Bethlehem Steel	International Nickel	Union Carbide
Chrysler	Johns-Manville	United Aircraft
Corn Products Refining	Loew's	U.S. Steel
Du Pont	National Distillors	Westinghouse Electric
Eastman Kodak Company	National Steel	Woolworth

Table 2.8: Companies in the Dow Jones Industrial Average (December of 1979)

Allied Chemical	General Foods	Owens-Illinois Glass
Aluminum Company of America	General Motors Corporation	Proctor & Gamble Company
American Can	Goodyear	Sears Roebuck & Company
American Telephone & Telegraph	Inco (formally International Nickel)	Standard Oil of California
American Tobacco B	International Business Machines	Texaco Incorporated (formally Texas Company)
Bethlehem Steel	International Harvestor	Union Carbide
Du Pont	International Paper Company	United Technologies Corporation (formally United Aircraft)
Eastman Kodak Company	Johns-Manville	U.S. Steel
Exxon Corporation (formally Standard Oil, NJ)	Merck and Company, Inc.	Westinghouse Electric
General Electric Company	Minnesota Mining & Manufacturing	Woolworth

Table 2.9: Companies in the Dow Jones Industrial Average (December of 1994)

AlliedSignal Incorporated (formally Allied Chemical)	Eastman Kodak Company	Minnesota Mining and Manufacturing
Aluminum Company of America	Exxon Corporation	Philip Morris Companies, Incorporated
American Express Company	General Electric Company	Proctor & Gamble Company
AT&T Corporation (formally American Telephone and Telegraph)	General Motors Corporation	Sears Roebuck & Company
Bethlehem Steel	Goodyear	Texaco Incorporated
Boeing Company	International Business Machines	Union Carbide
Caterpillar Incorporated	International Paper Company	United Technologies Corporation (formally United Aircraft)
Chevron (formally Standard Oil of California)	J.P. Morgan & Company	Walt Disney Company
Coca-Cola Company	McDonald's Corporation	Westinghouse Electric
Du Pont	Merck & Company, Inc.	Woolworth

Table 2.10: Companies Currently Included in the Dow Jones Industrial Average (September of 2004)

3M Company (formally Minnesota Mining & Manufacturing)	Exxon Mobil Corporation (formally Exxon)	McDonald's Corporation
Alcoa Incorporated (formally Aluminum Company of America)	General Electric Company	Merck & Company, Inc.
Altria Group, Incorporated (formally Philip Morris Companies	General Motors Corporation	Microsoft Corporation
American Express Company	Hewlett-Packard Company	Pfizer Incorporated
American International Group Inc.	Home Depot Incorporated	Proctor & Gamble Company
Boeing Company	Honeywell International Inc. (Allied Signal merged with Honeywell)	SBC Communications Incorporated
Caterpillar Incorporated	Intel Corporation	United Technologies Corporation
Citigroup Incorporated	International Business Machines	Verizon Communications Inc.
Coca-Cola Company	J.P. Morgan Chase & Company (J.P. Morgan merged with Chase)	Wal-Mart Stores Incorporated
Du Pont	Johnson & Johnson	Walt Disney Company

Table 2.11: Companies Currently Included in the Dow Jones Industrial Average (September 2004) That Were Also Included 50, 25, and 10 Years Ago.

December of 1954	December of 1979	December of 1994
DuPont	Alcoa Incorporated	3M Company
Exxon Mobil Corporation (formally Exxon/Standard Oil of NJ)	DuPont	Alcoa Incorporated
General Electric Company	Exxon Mobil Corporation (formally Exxon/Standard Oil of NJ)	Altria Group, Incorporated (formally Philip Morris)
General Motors Corporation	General Electric Company	American Express Company
Proctor & Gamble Company	General Motors Corporation	Boeing Company
United Technologies Corporation (formally United Aircraft)	International Business Machines	Caterpillar
	Merck & Company, Incorporated	Coca-Cola Company
	Proctor & Gamble Company	DuPont
	United Technologies Corporation (formally United Aircraft)	Exxon Mobil Corporation (formally Exxon/Standard Oil of NJ)
		General Electric Company
		General Motors Corporation
		Honeywell International Inc. (Allied Signal merged with Honeywell)
		J.P. Morgan Chase & Company (J.P. Morgan merged with Chase)
		McDonald's Corporation
		Merck & Company, Incorporated
		Proctor & Gamble Company
		United Technologies Corporation (formally United Aircraft)
		Walt Disney Company

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2.9. Research Needs

The knowledge on virtual enterprises has grown considerably in the recent past; however, much more is needed in order to acquire a greater understanding. Many authors point out specific areas of need and concern. Given below are general areas of need that were found when reviewing virtual enterprise literature. These areas were assimilated based on common themes found among the list of direct quotes that are presented in Appendix C.

2.9.1. Formation [Kernohan, 1999; Cooper and Muench, 2000; Choi and Bae, 2001; Eschenbacher, et al., 2001]

The establishment of a virtual enterprise is very important because a new group of partners is brought together and must be able to interact and perform in an effective manner in order to compete. This configuration means that a significant amount of risk is acquired in the process. Therefore, it is essential that some common structure be established in order to map out proper configuration procedures.

2.9.2. Communication [DeSanctis and Monge, 1999; Kasper-Fuehrer and Ashkanasy, 2001; Ahonen, et al., 2001] **and Trust** [Kasper-Fuehrer and Ashkanasy, 2001]

The distributed structure of virtual enterprises results in barriers of communication that are often to a higher degree than those within a brick and mortar organization. There is a great need for research in the area of communication within virtual enterprises because of these barriers and the importance of communication to success. A related topic is the need for trust among members of the virtual organization. The accelerated

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formation and temporary nature of virtual enterprises do not allow partner organizations to spend large amounts of time to develop strong relationships. Members must have efficient and effective interaction to offset this. Whether it is communicating values, ethics, goals, visions, etc., one partner's trust for another is partially dependent on proper communication. Other factors of trust in virtual settings are also unclear and must be investigated.

2.9.3. Decision Support [Strader, et al., 1998; Biggs, 2000; LeCompte, et al., 2000; Wortmann and Szirbik, 2001]

A vast array of decisions must be made within a virtual organization. Those decisions are often magnified due to the distributed structure of virtual enterprises. Research is needed to develop decision support systems that allow the appropriate information to be available to management in a quick and accurate manner.

2.9.4. Management Issues [Ahuja and Carley, 1999; Staples, et al., 1999; Eschenbacher, et al., 2001; LeCompte, et al., 2000; Zhou, et al., 2000; Cascio, 2000]

Determinants of effective performance in a virtual enterprise are unclear and provide fertile areas of investigation. Other areas of exploration include the problems associated with managing remote workers and methods for dealing with the effects that a virtual setting has on production planning and control.

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2.9.5. **Legal Issues** [DeSanctis and Monge, 1999; Eschenbacher, et al., 2001]

The legal aspects of foundation, production, termination, etc., arise due to the transitory partnerships that form a virtual enterprise. The necessity and type of contractual arrangements, especially in regard to the looseness of a virtual structure, are valid opportunities for further examination.

CHAPTER III

DEFINING AND CLASSIFYING VIRTUAL ENTERPRISES

3.1. Defining a Virtual Enterprise

An abundance of literature is devoted to defining and explaining the concepts of virtual enterprises. Despite many attempts, the research is unclear when it comes to distinguish what a virtual enterprise truly is. The quotes below authenticate this point.

- "A general drawback to all behavioral science research on VOs is their inherent 'temporariness.' In addition, there is a hodgepodge of descriptions of them. Researchers need to push for definitional clarity, as well as to investigate many different types of networks and VOs." [Grabowski and Roberts, 1999]

- "New, more specific theories of network and emerging organizations are needed that describe both characteristics of VOs and processes that give rise to their evolution." [Grabowski and Roberts, 1999]

- "However, there is little empirical research on structure of virtual organizations. Further, since the research on virtual organizations is still evolving, the literature lacks precision on the terminology used to describe them, particularly with respect to structure." [Ahuja and Carley, 1999]

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- "A central problem of further empirical analysis will be the differentiation of Virtual Enterprises in qualitative terms." [Eschenbacher, et al., 2001]"The discussion of VOs has traditionally been characterized by ambiguity about the characteristics and implications of VOs. Even the expression 'virtual organization' is still unclear." [Kasper-Fuehrer and Ashkanasy, 2003]

This portion of the research addresses the need for definitional clarity by 1) developing a more comprehensive definition of virtual enterprises (see the remainder of this section) and 2) by developing a classification of virtual enterprises based on the motivations for origination (see Section 3.2).

3.1.1. The "Virtual Enterprise" Concept

Prior to defining a virtual enterprise, it is necessary to examine the terms "virtual" and "enterprise." Merriam Webster [MWOD] defines "virtual" in three ways:

1) "being such in essence or effect though not formally recognized or admitted"

2) "of, relating to, or using virtual memory"

3) "of, relating to, or being a hypothetical particle whose existence is inferred from indirect evidence"

The term "enterprise" has the following definitions:

1) "a unit of economic organization or activity"

2) "a systematic purposeful activity"

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The combined terms entail an organization that has evidence of existence, yet is not recognized as a formal organizational structure.

From a virtual enterprise standpoint:

1) The product or service provides the evidence of existence.

2) The lack of a legal framework [Kasper-Fuehrer and Ashkanasy, 2003] removes the formal nature of existence.

3.1.2. A Comprehensive Definition

A search of the literature shows that while virtual enterprises have common characteristics, individual authors often define a virtual enterprise from different viewpoints. Appendix D provides formal definitions as stated by various authors.

Key words and phrases were drawn from each of the definitions in Appendix D. The list of key words and phrases was then condensed by combining similar words and phrases. The condensed format was then linked to the individual authors to better identify similarities and differences among the individual definitions. This list may be seen in Table 3.1. Given the compilation of definitions and the common characteristics discussed in Section 2.3, the following high-level definition of a virtual enterprise is established:

A virtual enterprise is a temporary network of organizational entities linked together by information and communication technology, each concentrating on their core competency(ies), who share skills, costs, resources, data, etc., and

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Table 3.1: Key Words and Phrases Within Virtual Enterprise Definitions

	Christie, et al. 1998	Kernohan, 1999	Desanctis and Monge, 1999	Gil-Estallo, et al. 2000	Byrne and Brandt, 1993	Levary, 2000	Ahuja and Carley, 1999	Mgrs's Intelligence Report, 2001	Arnold, 1995 (in Kanet and Fist, 1999)	Fuehrer and Ashkanasy, 1988	Lau and Wong, 2001	Lau and Wong, 2001 (Davidow and Malone, 1993, #1)	Choi and Bae, 2001	Eschenbacher, et al. 2001 (Goldman, 1995)	Furst and Schmidt, 2001	Camarinha-Matos, 2001	Ahonen, et al. 2001	Znoe, et al. 2001	Cascio, 2000
temporary	x			x	x		x		x			x				x	x	x	
network of (geographically distributed) business partners	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
specific purpose / goal	x				x		x	x					x	x					x
dissassemble when goal met	x						x												
utilize information / e-business technology		x	x		x		x		x				x		x	x			
different levels contribute			x																
don't necessarily coincide in time or space			x																
share skills, costs, markets, data, etc				x	x						x					x	x	x	x
powered by time-based competition					x														
long term common interest or goal						x													
come together quickly								x	x									x	
exploit an apparent market opportunity								x	x	x		x				x		x	
core competencies									x										
act as a single unit									x										
enterprise cooperation																			
subset of virtual organization													x						
potential partners for future cooperation													x						
less regard for organizaitons, locations, computing environments, or technologies																		x	
virtual in organization, location, and technology																		x	
pursue common objectives																			x

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collaborate through the leadership of one of its members (known as the broker / strategic core) in order to better meet specific market opportunities and thereby produce a better outcome.

3.2. A Classification of Virtual Enterprises

Much like a computer uses virtual memory to increase its capacity and performance, a virtual enterprise optimizes its capacity and performance by reaching beyond its physical limitations. That is, virtual enterprises temporarily rely on partners to provide resources to help accomplish tasks that otherwise would be impossible.

While computers use virtual memory for a single purpose, organizations do not use virtuality for a single or static reason. The different reasons for origination serve as a way to differentiate and better define virtual organizations.

Three major categories are used to classify the structure of virtual enterprises. Each category contains related root motivators of virtual enterprise formulation. The categories include virtual enterprises that are: 1) need based, 2) objective based, and 3) culture based.

3.2.1. Need Based Virtual Enterprises

Need based virtual enterprises originate because an organization is either not capable of performing a specific process or is unable to adequately perform the process. The literature reveals three primary need based virtual enterprises. They are those with technological / resource deficiencies, lack of expertise, and insufficient capacity.

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3.2.1.1. Technological/Resource Deficiencies

Organizations that lack the technology to ideally perform a specific process often lack the financial capability to obtain the respective technology. Such situations result in sub-optimization. Consider Ahonen, et al. [2001], who demonstrated the advantage of virtual enterprises to cutting stock applications. The solution to cutting stock problems often requires automated tools. The automated tools, in turn, necessitate training. Companies that are unable to fund these needs rely on human expertise to solve the problem. Virtual enterprises allow access to these technologies without the financial burden of purchasing them and the training of employees to operate them. The result is a win-win situation. The company lacking the technology obtains a high quality product with lower overall investments, and the company with the technology is able to increase its return on investment.

3.2.1.2. Lack of Expertise

Customer demands are increasingly calling for products that are highly complex. The complexity requires expert knowledge to adequately design, manufacture, and service the products. A company wishing to respond to ever-changing customer needs might not possess the necessary expertise and is therefore forced to turn elsewhere.

The open source software industry provides a unique look into how a wide array of expertise cooperates to achieve a better result. [Mecker, 1999] Open-source software (e.g.- the Linux Operating System) is essentially a public good that is primarily built by

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participants that are not employees and receive no direct compensation. The motivation for participating extends beyond money. In fact, the enjoyment of helping others, enhanced reputation, and better end products inspire participation.

Organizations that take advantage of expert knowledge via virtual enterprises obtain similar benefits. These benefits include higher quality products, minimization of production costs, and a shortening of the product life cycle. [Choi and Bae, 2001] Additionally, the organization with the expert knowledge is able to concentrate on the processes it specializes in and is subsequently motivated to achieve a high level of performance. In turn, it enhances its name and makes it easier to attract future business.

3.2.1.3. Insufficient Capacity

Virtual enterprises often form because organizations lack the technology or knowledge needed to produce a desired product. While this is true, virtual enterprises also form when organizations have the technology and knowledge necessary – just not the proper amount at the proper time. Insufficient capacity, in combination with the desire to fulfill contractual obligations and/or achieve a higher volume of sales, drives virtual enterprise formation.

In addition, seasonal items affect the capacity available to organizations. Companies often respond to the need for additional capacity by either producing in advance or increasing capacity. Each has its advantages, but each is not without disadvantages. For example, producing in advance increases inventory costs and involves the risk of having

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backlogs or overstocks. These risks lead to the potential for lost sales or mark-downs. Increasing capacity, on the other hand, may call for expensive investments in assets that will only be useful during the product's season. Virtual enterprises provide for the capacity and flexibility needed while allowing organizations to avoid the potential disadvantages associated with producing in advance or physically accumulating additional capacity.

3.2.2. Objective Based Virtual Enterprises

Objective based virtual enterprises form with a specific goal in mind. The primary goal is to increase the profit of the enterprise. Individual situations determine how the goal is obtained. The types of objective based virtual enterprises include those based on location, cost, and quality.

3.2.2.1. Location

Virtual enterprises provide the ability for companies to reach markets that otherwise would be difficult to enter. For example, an organization might partner with a company in a foreign country. The partnership provides a foothold to enter new markets [Bleecker, 1994]. Strader, et al. [1998] give an example of Rosenbloth Travel Agency, which went from a highly successful regional agency (sales of $40 million) to a national giant with $1.3 billion in sales. The growth primarily resulted from their ability to globalize by way of the Rosenbloth International Alliance. Rather than expanding and developing their

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own people with local expertise, they partnered with previously established agencies in foreign locations. The numbers tell the rest.

In addition to trying to reach new markets, location related virtual enterprises also arise because certain vendors may simply be in a more strategically advantageous site. For example, a virtual enterprise would take advantage of a company that (because of location) has reduced labor and/or delivery charges. The dynamic nature of virtual supply chains allows members to wring out the costs in the manufacturing process [Binstock, 2000]

3.2.2.2. Cost

The bottom line determines, for the most part, whether or not an organization is successful. Companies often find that it is simply more expensive to perform a process in-house than to perform it elsewhere. This is a key reason that many organizations sub-contract. Sub-contracting requires less investment in resources such as labor, tools, space, and time. Firms can then focus scarce resources to provide increased advantages. [Christie, et al., 1998]. Virtual enterprises also benefit from these relationships by allowing organizations to perform processes that otherwise would have added cost if they had performed them in-house. The advantage that virtual enterprises add is that these sub-contractual relationships are often temporary in nature because they are used to meet a specific need at a specific time. The temporary relationships allow for added flexibility when a similar need arises in the future. That is, the same organization may not be

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chosen for sub-contracting because a new organization may provide the same service with the same quality for a lower cost.

3.2.2.3. *Quality*

While cost is a major issue, there are other factors that make certain suppliers (etc.) more desirable than others. These factors are termed value-added services. For example, a company may compete on quality. A higher quality product differentiates it from the market. Given a desire to compete on quality, the organization will prefer suppliers with superior products to those with favorable pricing. [Binstock, 2000]

3.2.3. Culture Based Virtual Enterprises

Virtual enterprises do not always arise because of a given need or objective. Certain types of businesses utilize the virtual strategy in order to survive. Were these types of businesses to revert to a non-virtual strategy, they would be unable to keep pace with the needs of customers in today's society. In addition to those who need the virtual strategy for survival, there are those who adopt virtuality as a way to do business. These situations are rare and represent the purest form of virtual enterprises. Culture based virtual enterprises include pure virtual enterprises and those that are virtual dependent.

3.2.3.1. *Virtual Dependant / Type of Business*

Customer needs and desires change continually. To maintain customers, businesses respond with new and improved products. While change is a constant in today's world, it

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is clear that not all product life cycles progress at the same speed. Both the nature of the product and the technology involved play key roles in determining life cycle duration. Short product life cycles require quick response while maintaining quality and customer satisfaction. Christie, et al. [1998] state that virtual organizations offer the power and flexibility to respond quickly to changes in the environment and deliver new products. They specifically point out that virtual organizations are especially useful in industries that manufacture products that become obsolete in short periods of time (e.g., apparel and electronics).

Rapid technological changes have produced shorter product life cycles and have significantly altered how companies do business. For example, the computer industry must maintain pace with the latest technological innovations. For a single company to stay up to date with all aspects of the businesses would be almost impossible and extremely expensive. Conversely, a group of companies, each concentrating on a specific aspect of the overall process, allows such businesses to maintain pace with the technological advances. Furst and Schmidt [2001] and Choi and Bae [2001] (in reference to Bloch and Pigneur [1995]) agree by saying that virtual enterprises provide a model for the development of complex and highly technical products and services. In addition, Fitzpatrick and Burke [2000] further describe that virtual enterprises provide the ability to maintain the latest innovations by taking advantage of dynamic supply chains.

3.2.3.2. Pure Virtual Enterprises

Virtual Enterprises of the purest form encompass the key components of the definition as a continual means of doing business. They depend on proper identification of opportunities and temporary partnerships. Companies that are partners for one period of time may become competitors on the next opportunity and partners again a short while later. Change is the only constant within these structures.

Pure virtual enterprises exist on a limited basis partly because of their continually dynamic nature and the associated risks. The construction and movie industries provide two examples of the pure virtual nature. The difference between the structure of traditional businesses and that of pure virtuality is very large. The large gap creates a barrier to the virtual world that is hard to completely cross. This is especially true for businesses that are already established. In addition, the size of the organization conceivably adds to this difficulty. As a result, the majority of virtual enterprises only have some aspect of virtuality.

CHAPTER IV

PROACTIVELY ADDRESSING PROBLEMS FACED BY

VIRTUAL ENTERPRISE BROKERS:

AN INTRODUCTION

Recent literature touts virtuality as a means for organizations to rapidly respond to customer needs and maintain competitiveness. Indeed, it is often seen as a new dimension to organizational structures. Despite the fact that recent trends support this move, the virtual enterprise concept is not new. Two conclusive examples are the film and construction industries. Both, by definition, are purely virtual: they are a temporary group of partners that come together to achieve an objective and are tied together by communication and the leadership of a central coordinating figure. Once the objective is achieved, they disband and may or may not form a partnership with each other on future projects.

Even though a history is present and despite the fact that the literature provides numerous definitions of virtual enterprises, a clear picture of the exact nature of virtual enterprises is not available. Additional research is needed to clarify the key characteristics of virtual enterprises.

This portion of the research will aid in the clarification process by identifying and investigating the key problems currently facing the brokers of virtual enterprises. In

addition, this research will develop a conceptual model to aid brokers in the development of a virtual enterprise and thereby proactively address the key problems. In developing the model, processes and tools potentially capable of addressing the key problems are identified. The processes and tools relate to specific approaches documented in the virtual enterprise literature as well as approaches inherent to other disciplines, but potentially useful in a virtual environment.

4.1. Managerial Functions [Babcock, Daniel B., 1996]

Henry Fayol [1949] separated the activities of management into five key elements: planning, organizing, command, coordination, and control. Since then, many other authors have developed their own lists. For example, Weihrich and Koontz [1993] favored planning, organizing, staffing, leading, and controlling. Given the fact that most authors include staffing with controlling and few isolate coordinating as a separate function, an inclusive list of the functions of management is as follows: planning, organizing, leading, and controlling.

- Planning – identification of the missions and objectives and the activities necessary to achieve them

- Organizing – developing the roles for members of the organization and filling those positions

- Leading – motivating others to achieve the objectives and goals of the organization

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- Controlling – ensuring that activities conform to plans through measurement and corrective actions

4.2. Relationships Between the Virtual Enterprise Life Cycle and the Functions of Management

The Identification phase of virtual enterprises relates primarily to the planning function of management. First, there must be recognition of the opportunities that exist. Recognition of opportunities leads to an evaluation of the opportunities and a selection of the most advantageous opportunity. The organization must also identify a vision, purpose, and mission for the opportunity at hand. Also included is the necessity to develop a strategy and proper goals and objectives in order to fulfill the vision of the organization.

The Identification phase also includes activities based on the organizing function. Specifically, the broker organization must determine the tasks necessary to produce the respective product or service. Identification of the tasks opens the way for the Formation Phase of the virtual enterprise life cycle.

The Formation phase also involves the organizing function. This is primarily seen in terms of staffing or selecting the organizations for partnership. The lead organization (a.k.a. broker) develops a group of potential partners, evaluates, and selects among them. Once partners are selected, the partners come together to form the virtual enterprise and pursue the market opportunity. Scheduling, communication, policies, contractual

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arrangements, and other coordinating activities are a part of the Formation phase and are necessary for successful operation.

The Operation phase of the virtual life cycle links with the leading and controlling functions of management. Numerous major decisions are encountered during this phase, and they are usually dependent on input and output from the other operational decisions. These non-sequential relationships make for a more difficult management situation. In this phase, the individual members of the virtual organization conduct their respective activities based on a timeline set for the completion of the product or service. As with traditional organizations, attainment of the highest level of performance depends not only on skills and resources, but also on the degree to which member organizations are motivated to achieve their objectives and those of the virtual enterprise as a whole. While the controlling function is carried out in the Operation phase, it is dependent on proper and effective planning. Member organizations must develop appropriate standards, measure performance, compare performance to the standard, and take corrective action when any deviation occurs. The passing of the market opportunity ends the Operation phase.

Termination of the virtual enterprise depends on ceasing operations and asset dispersal. Asset dispersal requires the input of all accounting and legal agreements or contractual arrangements. Once these are accomplished, member organizations are free to pursue other market possibilities and virtual partnerships.

Table 4.1 summarizes the relationships between the virtual enterprise life cycle and the functions of management.

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Table 4.1: Relationships Between the Virtual Enterprise Life Cycle and the Management Functions

	Planning	Organizing	Leading	Controlling
Identification	Identify, evaluate, and select market opportunity(ies); Develop vision, mission, purpose; Develop strategy and the goals and objectives to fulfill vision	Determine tasks necessary to produce the product or service		
Formation	Develop standard for which potential partners will be evaluated.	Develop a group of potential partners, evaluate, and select partners; develop schedules, policies, contractual arrangements, and other coordinating activities		
Operation	Determination of motivational tactics for geographically dispersed members; development of appropriate standards for performance measurement		Individual members conduct their respective activities; application of motivational tactics for geographically dispersed members. Broker organization oversees the virtual enterprise.	Measure performance, compare performance to identified standards, take corrective action for deviations
Termination	Develop most appropriate techniques for ceasing virtual enterprise operations	Cease operations; disperse assets among member organizations (based on accounting and legal information)		

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4.3. Problems in the Management of Virtual Enterprises

Information Technology has contributed to the virtual enterprise movement more than any other factor. The ability to connect organizations and disseminate information in a quick manner opens the door for many benefits. Higher quality products, better customer service, quicker time to market, larger markets, flexibility, and access to previously unavailable resources are all potential advantages of the virtual enterprise. While the temporary networking results in appealing advantages, the management of the network results in certain problems that must be addressed – more specifically, interface management problems. The management activities where key problems arise include: select partners, develop trust, develop culture, enhance behavior through motivation, and develop communication. See Figure 4.1. Each activity relates to the other individual activities and affects the degree to which the problems occur. For example, a person who is highly motivated to achieve a task is more likely to effectively communicate with other partners. Likewise, a person who effectively communicates a need to others is likely to increase the motivation to achieve that need. (Table 4.2 provides examples of how the activities relate. Note that the table is read from left to right. That is, read in terms of how a particular activity in a row relates to a particular activity in a column.) In addition, the problems in the individual areas as well as the interaction of the problems affect the degree to which the potential advantages are achieved (see Figure 4.2). Therefore, it is imperative that those involved with virtual enterprises develop a proper understanding of the problems in these areas, as well as ways to address them.

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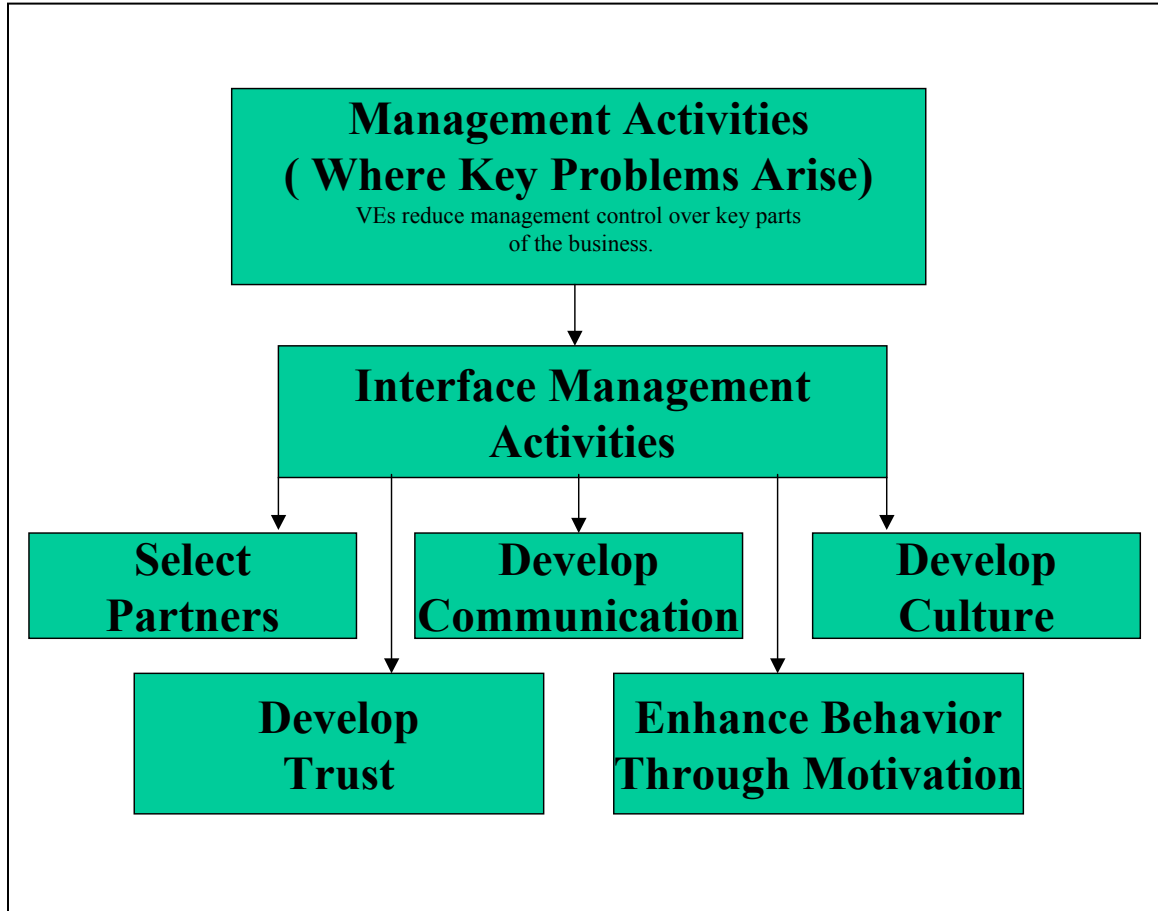
Figure 4.1: Management Activities Where Key Problems Arise in Virtual Enterprises

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Table 4.2: Interactive Relationships Between the Management Activities with Virtual Enterprise Problems

	Select Partners	Develop Trust	Develop Communication	Enhance Behavior Through Motivation	Develop Culture
Select Partners		The lack of individual initiative by members can result in low trust levels. (Jarvanpae and Leidner)	Geographically distributed members exhibit the power of the virtual form through product or process innovation that results from new or qualitatively different communication (Desanctis and Monge, Ring and Van de Ven, 1994)	Certain organization are often more motivated to work with some than with others.	Virtual Enterprises, despite being composed of distinct cultures and associated problems, will support their own unique cultures. (Hartman and Guss, 1996; Norton, 1994)
Develop Trust	Partners that take advantage of others may never be chosen again. (Strader, et al)		A virtual enterprise is strengthened by collaboration and continual, open two-way communication, despite the fact that members may be competitors in other areas. Trust is, therefore, a necessity among members. (Christy and Levary, 1998)	In virtual enterprises, when traditional hierarchical control mechanisms are absent, trust is a necessity to ensure effective functioning. (Kasper-Fuehrer and Ashkanasy)	Virtual enterprises develop their own culture. The degree of trust among members will affect the degree to which fruitful relations are developed. (Frank, Ulrich, 1999)
Develop Communication	E-communication allows the means to show interest in forming relationships that otherwise would be impossible or difficult to sustain. (DeSanctis and Monge; Falk et al., 1996)	In order for swift trust to be maintained, members must communicate enthusiastically. (Jarvanpae and Leidner,1998, 1999)		The media used by virtual enterprises is not only for information transfer, but should also enable social relations that build and maintain trust, satisfaction, and commitment. (Suchan and Hayzak, 2001)	Open and effective communication among virtual members is needed to effectively align objectives, needs, and applicable processes. (Hartman and Ashrafi, 1996)
Enhance Behavior Through Motivation	High motivation, paired with capability, provide for a desire to partner.	Team cooperation, trust, and communication can be undermined by unhealthy competition for rewards. (Suchan and Hayzak, 2001)	Performance evaluation and compensation systems must be adapted to motivate managers to cooperate with other members in order to improve performance of the virtual enterprise. (Strader, et al)		In order to strengthen a corporate culture, one must prevent rival values from contaminating employees. In addition, employee knowledge and purpose must be aligned with the normative framework of the organization. (Wilson, 1999)
Develop Culture	Tushman and O'Reilly state that cultures that are more likely to embrace virtuality are those that are highly decentralized, accepting of technology, and change oriented. (Burn and Barnett, 1999; tush and O'Reilly)	Different types of culture and associated values may not agree with other's values; trust issues immediately arise.	Communication and group behavior vary due to differences in culture. (Jarvanpae and Leidner, 1999; Gudzhurst, 1997)	The lack of an organizational context in virtual settings (sue to differing cultures) can lead to team fragmentation, inter-unit competition, and obstacles in knowledge flow. (Hartman and Guss, IEMC 1996; Bartlett and Ghoshel, 1996)	

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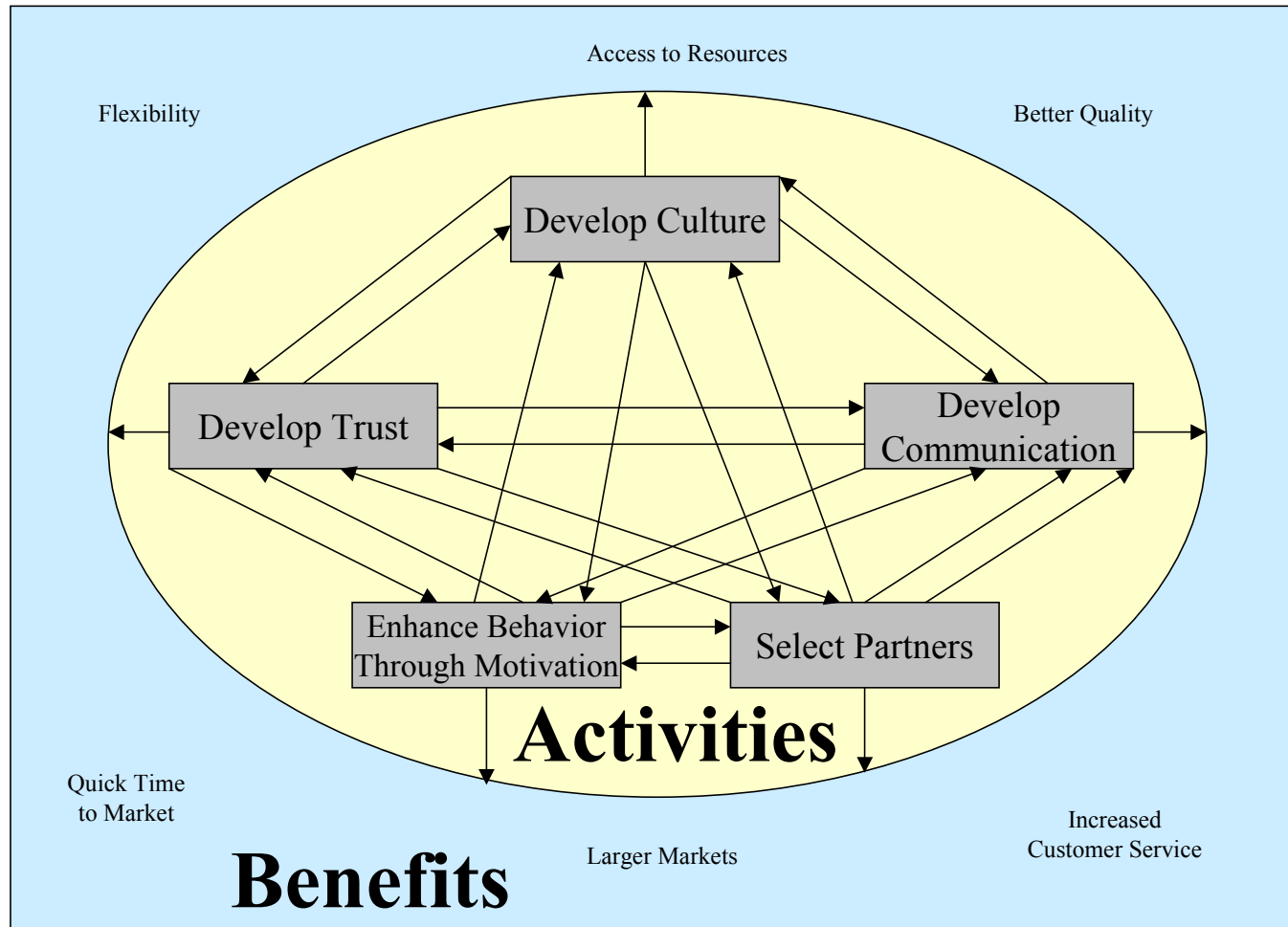
Figure 4.2: Possible Interaction of Activities and Their Influence on Potential Benefits

4.4. Problems and Virtual Enterprise Classifications

Section 3.2 discusses the major classifications of virtual enterprises: need based, objective based, and culture based. The classifications represent levels of virtuality. That is, the degree of virtuality increases with each virtual enterprise classification (need < objective < culture). Consider need based virtual enterprises. They exist exclusively because of a deficiency within a traditional organization. These deficiencies are often caused by economic limitations and seasonality demands. Whether technology, knowledge, or simply capacity deficiencies, need based virtual enterprises exist solely to address the deficiency. On the other hand, objective based virtual enterprises exist because the broker organization (while capable of performing the necessary task) is actively seeking a partnership so as to better meet a desired goal. Finally, culture based virtual enterprises not only actively seek partnership; they rely on the virtual structure for survival.

In addition to a more magnified need to address the interface problems, it can be said that within each virtual enterprise classification, certain interface problems stand out more than others. These problems are identified below. Please notice, however, that partner selection is not mentioned. This is because it is a key foundation to a successful virtual enterprise, no matter the classification of virtual enterprise.

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4.4.1. Need Based

Need based virtual enterprises are most susceptible to trust and motivation problems. Economic limitations and spikes in demand often cause these types of virtual enterprises. These needs place the broker organization in a vulnerable position because they do not have the capability to perform the necessary task. The organizations with whom they contract understand this and may potentially exhibit lower levels of motivation to perform. Practically speaking, this relates to our human nature in situations where people need us for something, but we do not likewise need them. In these situations we are often less motivated to complete the task because they have little or no *physical* impact on us.

In addition, need based virtual enterprises may form in a rushed manner in order to meet some pressing need. Rushed decisions mean that partnerships are formed in a less than ideal manner. The result is that the broker organization enters the partnership with a lowered degree of trust and there is a potential for trust problems throughout the existence of the virtual relationship.

4.4.2. Objective Based

Unlike need based virtual enterprises, objective based virtual enterprises are capable of performing the task(s) that they desire to contract out to other organizations. This contributes to more ideal situations for partner selection decisions and the degree of trust placed in an organization upon partnership. Objective based virtual enterprises, however, do exist to meet some objective; such as lower cost, better quality, and/or enter new

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markets. This signifies that broker organizations are constantly focusing on new, external ways to improve in these areas: more ideal virtual partners. The down side of changing partners is an increased probability that partner organizations will not possess common ideals, methodologies, and beliefs for operating a business. Therefore, objective based virtual enterprises are susceptible to culture related problems. While this is especially true for organizations desiring to enter new markets (that often have localized cultural beliefs), this is also true for organizations wanting to meet other types of needs. Cultural differences are not due solely to geographic location; they exist from company to company.

4.4.3. Culture Based

For organizations that utilize and depend on the virtual structure for survival, the importance of each decision becomes even more magnified. The brevity of these structures, due to products that become obsolete in short periods of time, further inhibits the ability to properly communicate and make ideal decisions. Hence, culture based virtual enterprises face obstacles to communication when communication is needed the most. In addition to potential communication problems, another issue likely to arise is that of trust. Because culture based virtual enterprises are characteristically short-lived and continually changing, the probability is increased that partner organizations will become competitors in the future. As a consequence, the organizations (when partners)

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naturally worry about sharing information that may be used in the future to erode a competitive advantage.

4.5. Methodology for Addressing the Problems

The increased movement to a virtual structure requires organizations to conduct new and/or unproven operational and managerial techniques throughout its life cycle. Such situations are conducive to exploration and research into addressing the needs. In terms of interface management problems, the literature specifically highlights five management activities where key problems arise: select partners, develop communication, develop culture, develop trust, and enhance behavior through motivation.

In order to properly address the problems, it is important to: 1) understand the factors that drive their development and 2) understand the principal relationships between the activities. The literature does not specifically address these relationships, but it does suggest that the activities are interrelated (refer to Table 4.2 and Figure 4.2). The web of relationships illustrated in Figure 4.2 provides for a potentially complex problem: determining the overall impact of specific improvements.

The purpose of the remaining portions of the research is to better understand the important relationships between the activities. Identifying these primary relationships brings structure to a potentially complex problem and allows brokers of virtual enterprises to proactively address the key problems.

Prior to determining the primary relationships among the management activities, this research appropriately considers the design of virtual enterprises. In any situation, proper design is a key determinant for success. This is especially true with virtual enterprises, whose designs are constantly changing based current market opportunities. To address this topic, a proven design technique known as systems engineering is applied in the next chapter to the formation of virtual enterprises.

CHAPTER V

USING SYSTEMS ENGINEERING TO DESIGN

VIRTUAL ENTERPRISES

We live in a world of systems. Each system exists in order to address a need. Systems engineering is a process for designing man-made systems to ensure that the system and each aspect of the system operates in the most efficient manner. A virtual enterprise is a temporary conglomeration of organizations that addresses specific customer needs. Because a virtual enterprise is a system, the systems engineering process is very applicable.

This chapter first presents background information on systems. The background information is used to define a virtual enterprise from a systems perspective. In addition, the systems engineering process is summarized and brief descriptions are provided for how well each element of the process relates to the formation of a virtual enterprise. Finally, this chapter discusses the tasks involved with creation of a virtual enterprise and translates those tasks into a work breakdown structure (WBS).

5.1. Systems: Background Information

Webster's Dictionary [2001] defines a system as "a set or arrangement of things so related or connected as to form a unitary or organic whole." Westerman [2001, p. 5]

states that a system is "an entity designed to function so as to achieve an objective."

Blanchard and Fabrycky [1998, p. 2] extend the idea of systems by saying that all

systems are composed of components that consist of more detailed components. These

definitions provide four key aspects of systems:

1) Systems are composed of components. Each of the components are smaller
   systems which are composed of components. A system within a system is
   known as a subsystem. A common hierarchy is system, subsystem, and
   component.

2) Each subsystem/component is chosen (see "design" in Westerman's definition)
   to function or perform a specific action.

3) Relationships tie the subsystems/components together and create a whole unit
   or entity.

4) The system is assembled to achieve an objective.

5.2. Defining a Virtual Enterprise from a Systems Perspective

Among the numerous definitions of virtual enterprises, Wilson [1999] provides one of

the most thorough: "a network or loose coalition of manufacturing and administrative

services using integrated computer and communication technologies to link differing

groups of personnel for a specific business purpose, disassembling when the purpose has

been met." The following is the previously discussed (see section 3.1.2) comprehensive

definition based on the author's personal research on virtual enterprises:

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A virtual enterprise is a temporary network of individual organizations linked together by information and communication technology, each concentrating on their core competency(ies), who share skills, costs, resources, data, etc., and collaborate through the leadership of one of its members (known as the broker / strategic core) in order to better meet specific market opportunities and thereby produce a better end result.

These definitions highlight major characteristics of virtual enterprises. In order to define a virtual enterprise from a systems perspective, a description of how the characteristics of virtual enterprises relate to the major behaviors of a system is given.

5.2.1. System Behavior #1: Systems are Composed of Subsystems and Components

Just as systems are composed of components, virtual enterprises consist of various services and/or manufacturing processes. These services and manufacturing processes are provided by individual organizations that partner to form the virtual structure. The partners and associated processes are considered subsystems in respect to the virtual enterprise system. Each subsystem consists of more detailed components. For example, Partner A's process utilizes a punch press. The punch press is considered a component in the partner's process.

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5.2.2. System Behavior #2: Subsystems/Components are Chosen to Perform a Specific Function

The broker of a virtual enterprise chooses partners based on their ability to perform specific processes. The virtual literature identifies these processes—the one or two processes that an organization specializes in—as "core competencies." The theory is that the virtual enterprise will perform at a higher level because each task is performed by organizations that specialize in the respective processes. The partners also choose specific components (based on function) to accomplish their tasks.

5.2.3. System Behavior #3: Relationships Tie the Subsystems/Components and Produce a Unitary Whole

Information and communication technology is often seen as the glue that holds the geographically distributed members together. [Grabowski and Roberts, 1999] In addition to the communication links, partners share skills, costs, and other resources in order to better perform their individual functions.

Dependency relationships among tasks also tie members of the enterprise together. For example, Company Y may not be able to complete their portion of the product/service until company X has completed their task.

5.2.4. System Behavior #4: Systems Work Together to Achieve an Objective

Virtual enterprises are temporary conglomerations of independent organizations. They cooperate in order to better meet a specific business objective.

In summary, a virtual enterprise is a system. The virtual enterprise system is composed of partner organizations that each perform specific functions. The partners and associated processes are sub-systems of the virtual enterprise system. Within each of the partners' processes are components that are utilized to perform the required function. Each level of the system is connected through tasks, communication, and through the sharing of skills and resources. Through these relationships, the levels work together to achieve a unified objective.

5.3. Systems Engineering: Background Information

There are numerous definitions of systems engineering. Consider Leonard [1999, p. 3]: "Systems engineering is an interdisciplinary engineering management process to evolve and verify an integrated, life cycle balanced set of solutions that satisfy customer needs." While definitions abound, most sources use similar systems engineering processes. Blanchard and Fabrycky [1998, p. 26] identify the following basic, general steps to the systems engineering process—requirements analysis, functional analysis and allocation, trade-off studies, synthesis, evaluation, specifications, and design review. (Please note that each of these will be described later.)

The systems engineering process is a top-down iterative problem solving process. It is applied sequentially in each stage of development (i.e., the system life cycle). [Leonard, 1999, p. 5] Blanchard and Fabrycky [1998, p. 19, 26] identify the following life cycle phases—conceptual design, preliminary design, detail design and development,

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production/construction, and operational use and system support. Each of these will be defined further as needed in the dissertation.

The basic premise to systems engineering is to initially design a system at a high level (i.e., the system level) and use an iterative process to break down the design into more detailed designs (i.e., sub-system and component levels) as necessary.

5.4. Systems Engineering as it Relates to the Formation of a Virtual Enterprise

Virtual enterprises are systems. Properly designed virtual enterprises provide unique advantages that often are not possible for single, independent organizations. The relative newness of the virtual enterprise concept means that the advantages of forming a virtual enterprise do not appear without potentially significant risks. Significant risks accompany the genesis of virtual enterprises. Improper planning and partnership decisions may lead to substantially reduced benefits, if not failure of the enterprise. Therefore, it is important that systematic and comprehensive planning and design techniques be used to develop the virtual enterprise system.

Given below are brief descriptions of how well each step of the systems engineering process relates to the formation of a virtual enterprise. For the purpose of structure in this chapter, Blanchard and Fabrycky's [1998] generic systems engineering process and system life cycle are utilized. An illustration of this may be found on page 26 of Blanchard and Fabrycky, 1998. In addition, the following relationships are assumed:

1) System Level ≡ Virtual Enterprise

2) Sub-system Level ≡ Individual Partners' Processes

3) Component Level ≡ Entities that Make Up the Partners' Processes

5.4.1. Conceptual Design

Conceptual design is the first phase in the system life cycle. It is also the first phase in which the systems engineering process is applied. Brokers begin conceptual design by identifying customer needs. Conceptual design ends with the transformation of customer requirements into design criteria. The design criteria are then used as a basis for more detailed system designs.

5.4.1.1. *Need Identification and Feasibility Analysis*

Customer needs drive the establishment of virtual enterprises. New products, improved products, and increased demand rates are all examples of needs that drive virtual enterprises—although virtual enterprises are not the only means to meet these needs. Brokers, however, use virtual structures to meet needs in a quicker, more cost efficient manner.

A feasibility analysis is used to determine if a need can be physically achieved and accomplished in a profitable fashion. A virtual enterprise broker obviously incorporates feasibility analyses into his/her decisions. Feasibility analysis is not only an up-front analysis; it is also a process that utilizes feedback from each step in the systems engineering process. Virtual enterprise brokers consider feasibility with each level of

system design. Determining requirements is an essential step in determining feasibility and is discussed next.

5.4.1.2. Requirements Analysis

It is important to perform a requirements analysis for each level of a system. Effective communication with, and an understanding of, the customer is necessary in determining their needs and desires. Addressing customer needs and desires impacts the requirements inherent to the system being designed. That is, customer requirements are transformed into system requirements describing what the system must do and how well the system must perform. [Leonard, 1999, p. 24] Major types of requirements include operational and maintenance and support. Each is discussed as it relates to virtual enterprises.

5.4.1.2.1. Operational Requirements

Blanchard and Fabrycky [1998, pp. 50-52] state that the major operational considerations are distribution and deployment, mission profile, performance and related parameters, utilization requirements, operational life cycle, and environment.

- Operational Distribution: Virtual enterprises intend to meet the needs of a specific target group. They are often created with the hope of extending their reach into new markets. Therefore, geographic reach of the product as well as the utilization of geographic-specific partners must be considered in the formation of virtual enterprises.

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- Mission Profile: While virtual enterprises are temporary in nature, they assemble to achieve a unified mission or objective. Beyond this mission, virtual enterprise brokers must address the functions necessary to achieve the mission and eventually partner with those capable of performing those functions.

- Performance Related Parameters: Brokers identify performance parameters from different perspectives. First, the customer's requirements are identified. Virtual enterprises primarily focus on meeting their customers' requirements, which leads to the advantage of having better customer service. Customer requirements influence performance parameters relative to the system used to meet the requirements. Therefore, brokers must also identify the performance levels necessary to operate the virtual enterprise. For example, a certain process may require a given throughput rate in order to accomplish the overall objective.

- Utilization Requirements: Brokers will only be able to partner with organizations that have the ability to sub-contract at appropriate usage levels. Therefore, it is necessary that those levels be identified.

- Effectiveness Requirements: Costs, dependability, downtime, skill levels, personnel levels, etc., are all characteristics that impact the efficiency and success of virtual enterprises.

- Operational Life Cycle: Virtual enterprises are temporary in nature. Once the objective is met, they disband. Planning, inventory requirements, and other manufacturing considerations are affected by the anticipated duration of the

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virtual enterprise. Therefore, it is important that brokers predict the expected life cycle.

- Environment: The environment is often thought of in terms of the elements in which the system will operate (for example, temperatures, vibration, and terrain). While these elements are considered for the products of virtual enterprises, another environment is also considered. The virtual enterprise environment has the characteristics of the markets in which the individual organizations operate as well as that in which the virtual enterprise operates. Examples include narrow or wide market bases, new products requiring entrance into consumer markets, competition levels among vendors, political elements, and legal issues. Environmental factors such as these play a key role in the feasibility and success of a virtual enterprise.

5.4.1.2.2. Maintenance Requirements

System maintenance and support requirements are often overlooked but are essential to the objectives of systems engineering. [Blanchard and Fabrycky, 1998, p. 53] The iterative nature of systems engineering results in maintenance and support being considered at progressively detailed levels (i.e., systems, sub-systems, and components). Virtual enterprise maintenance is accomplished at the systems level by ensuring that the individual partners work together effectively. For example, each partner and the associated tasks are to be coordinated. In addition, it is the responsibility of the broker to

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ensure that the virtual partners operate as a team in a reliable, effective manner. In order to accomplish this, brokers must address the interface management issues (trust, communication, culture, and motivation).

Sub-system maintenance (i.e., of the individual partners' processes) is more detailed and primarily a consideration beyond the formation stage of virtual enterprises. Maintenance consideration for the product (of the virtual enterprise) itself is, to a degree, possible at the conceptual design phase, but also depends on the partner's responsibilities for certain portions of the product. These more detailed maintenance concepts are important to the virtual enterprise. In general, they are determined after partner selection.

5.4.1.3. *Technical Performance Measures (TPM's) and Design Dependence Parameters (DDP's)*

Operational and maintenance requirements lead to technical performance measures. Technical performance measures are quantitative factors that are associated with developing the system. Design dependent parameters are based on technical performance measures and are incorporated into the design of the system, subsystems, and components. To identify TPM's and DDP's, it is important that the desires of the customer be identified. There are two primary customers of the virtual enterprise—end users of the product and the broker. The end-users of the product are of ultimate importance. Their desired performance measures must be considered in the design. End user requirements impact the level at which the virtual enterprise is to perform. It is the broker's job to transform end user requirements to system level requirements that ensure

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the system will perform appropriately. For example, end user demand rates influence production rates. Given a level of demand, a partnership with a desired company may or may not be possible due to available capacity levels. Another example is the relationship exhibited between product characteristics desired by the end user and the resource levels required from partners to meet the desired characteristics.

5.4.1.4. *Functional Analysis and Allocation*

According to Blanchard and Fabrycky [1998, p. 61], functional analysis transforms system requirements into detailed design criteria and identifies specific resource requirements at and below the subsystem level. The authors continue by stating that a function is an action that is necessary to accomplish an objective. [p. 62] It is also important to ensure that each function is based on a requirement. [Leonard, 1999, p. 24] For virtual enterprises, a system-level functional analysis results in the identification of the processes necessary to provide the product (examples include marketing, injection molding, and transportation). It is the broker's responsibility to identify the functions and find the appropriate partners to complete them. It is clear that functional analysis begins when a need is identified, and the analysis continues to iteratively break down requirements into detailed functions that must be performed at each level of the system. Functional analysis beyond the system level is a part of the preliminary design phase of the system life cycle. The relationship of these more detailed analyses to the virtual enterprise is discussed later.

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Allocation is the process of assigning requirements (from TPM's and DDP's) to the appropriate function responsible for their attainment. Virtual enterprise brokers consider desired requirements and the function responsible for achieving them, and incorporate both into the partner selection decision.

5.4.1.5. *Trade-Off Studies*

Trade-off studies, at the system level, are used to decide between alternative approaches to achieve the functions within prescribed performance parameters. For example, the functions may be accomplished through the use of equipment, humans, software, or a combination. The differences in quality, price, reliability, etc., (that are associated with alternate approaches) play a role in the performance of the overall system. Trade-off considerations dictate the decision to choose one method over another. Virtual enterprise brokers face the same situations in their decisions to utilize specific approaches to achieve necessary functions.

5.4.1.6. *Synthesis, Analysis, and Evaluation*

Blanchard and Fabrycky [1998, p. 67] state that synthesis is design. System level synthesis is based on the identified need and establishes relationships among the system components. The relationships are then analyzed and evaluated based on the initial requirements. The outcome is a potentially representative configuration of the system. Virtual enterprise brokers use this step of the systems engineering process to prepare a high-level understanding of the virtual partnership and to determine relationships

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between the functions. Further progressions (later stages of the system life cycle) are used to incorporate more detailed design aspects.

5.4.1.7. Type A Specification

Blanchard and Fabrycky [1998, p. 69] define a Type A specification as an engineering document containing the information derived from the needs analysis, "feasibility analysis, operational analysis, maintenance concept, and the functional analysis." While virtual enterprises may not physically develop a type A system specification, they do accomplish the steps that produce the information contained therein. Therefore, development of these specifications does apply to virtual enterprises.

5.4.1.8. Conceptual Design Review

Design reviews are performed at each stage of the design process to ensure that the design can perform the required functions at the required levels. Approved designs continue to the next stage. Again, this step in the systems engineering process is applicable and important to the formation of virtual enterprises. Brokers should only progress into more detailed designs if the high level designs are representative of the identified relationships and capable of achieving desired requirements.

5.4.2. Preliminary Design

Preliminary design is the second phase of the system life cycle. In this phase, the systems engineering process translates system-level requirements and design criteria into

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design requirements for the sub-system level and below. The major systems engineering concepts and their relation to virtual enterprise formation are discussed below.

5.4.2.1. Sub-System Functional Analysis

System-level functional analysis (conceptual phase) serves as the basis for sub-system functional analysis. Each individual function is evaluated to determine inputs, outputs, controls, and mechanisms utilized to accomplish the function. It is imperative that virtual enterprise brokers evaluate the major functions in this manner because partner selection depends on an organization's ability to provide the necessary resources to accomplish the task. Examples of these resources/mechanisms include machinery, specific knowledge areas and/or skill sets, and information technology. Knowledge of inputs is important because brokers must ensure that the necessary raw materials, data, and other resources are available to allow the partner to perform their function. Also, the broker must identify controls in order to understand the factors (political, environmental, technological, economic, etc.) that constrain the accomplishment of the function and overall ability for success.

A maintenance functional analysis should also be performed to identify the difficulties that may arise at the sub-system level. For a virtual enterprise, this analysis becomes more difficult to accomplish prior to partner selection. In a virtual enterprise, each function is performed by a different organization, each specializing in that particular

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process. Therefore, optimal maintenance concepts depend on the partner's advanced knowledge of their respective process and their process environment.

5.4.2.2. Requirements Allocation

Requirements allocation applies technical performance measures and design dependent parameters to the function and to the units responsible for their completion. The iterative nature of the systems engineering process ensures that those requirements are more specific than those identified during the conceptual phase. Virtual enterprise brokers determine which functions are responsible for the identified requirements. Their assignment becomes a major part of the request-for-proposal (RFP) process and the broker's determination of potential partners' qualifications. The result is the establishment of a specific set of criteria (qualitative and quantitative) that is to be met by those chosen as partners of the virtual enterprise. The criteria are process related (output rate, delivery time, cost levels, etc.) and product related (material specifications, tolerances, speed, etc.), with most containing a minimum, maximum, or range of acceptable requirements.

5.4.2.3. Trade-Off Studies

Proper allocation does not always ensure compliance with requirements. Available technologies may limit performance and require trade-offs that affect the system. Depending on the situation, virtual brokers can possibly recognize and determine these trade-offs prior to partner selection. A number of trade-offs at this level of the systems

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engineering process will require the partners' specialized knowledge of the subsystems. Therefore, the trade-offs may or may not be realized prior to partnership. One possibility is that potential partners could supply this information through the RFP process.

5.4.2.4. Synthesis and Evaluation

The design (or synthesis) of the preliminary system is more detailed and should conform to the identified requirements. High-level functions are decomposed (sub-system functional analysis) into lower-level functions and arranged in logical sequences. [Leonard, 1999, p. 37] The synthesis and evaluation procedures at this step include analytical means and/or the testing of physical models. Evaluation of the design at this level requires detailed data in order to construct the necessary models. The application of these models to virtual enterprises primarily appears after formation because of the process information possessed by the partners.

5.4.2.5. Specifications

Specifications are more detailed for the preliminary design phase. Conceptual design specifications focused on the system level. Preliminary design determines performance specifications for the sub-system, the product, and materials. [Blanchard and Fabrycky, 1998, p. 69] As a part of the formation process, brokers provide these specifications to potential partners. The request for proposal details specification requirements. Potential partners formally address their ability to meet the specifications, and the associated costs, through a proposal process.

5.4.2.6. Design Review

A preliminary design review ensures that overall requirements are met. The conceptual design review focused on the system level requirements. In the preliminary design phase, system requirements are translated to sub-system requirements. Once brokers determine that the design is capable of meeting the requirements, the preliminary design proceeds to the next level of design—detail design and development.

5.4.3. Detail Design and Development (and Beyond)

Detail design and development is the next phase in which the systems engineering process is applied. Detail design includes the technical aspects of sub-systems and components, preparing specifications and designs for components, developing and testing models of the system and components, and assessing the design's compliance with requirements. [Blanchard and Fabrycky, 1998, p. 97] For virtual enterprises, detail design and development, for the most part, occurs after formation of the virtual enterprise. Once partner selection decisions are made, the broker and individual organizations collaborate in order to provide a detailed design of the system. Proper designs are the basis for the remaining phases of the system life cycle— production/construction, operational use and system support, and retirement.

5.4.4. Systems Engineering and Virtual Enterprise Formation: Conclusions

Systems engineering is an iterative process for design. It is a top-down approach ensuring that system development progresses through distinct stages, each being more

detailed and depending on the previous stage. The progression of design stages includes system level design, sub-system level design, and component design (with more in-depth analysis as needed). These three stages relate primarily to the first three phases of the system life cycle—conceptual design, preliminary design, and detail design and development.

Virtual enterprises are systems used to address specific consumer needs. Because virtual enterprises are systems, the systems engineering process is very applicable. The formation of virtual enterprises is an especially important aspect because of the risk involved with planning for and selecting partners. In terms of virtual enterprise formation, the systems engineering process is especially applicable through the first two life cycle phases—conceptual design and preliminary design. While there are certain aspects of the process that are difficult if not impossible to accomplish prior to partner selection, a majority of the planning and design principles can be applied. Beyond these stages and the associated designs at the system and sub-system levels, the systems engineering process can only be continued through the selection of partners. The primary reason for this is because independent organizations are responsible for specific processes. The partners possess in-depth knowledge about their processes and the components thereof that the broker does not possess. Therefore, the detail design and development primarily occurs after formation of the virtual enterprise.

5.5. A Work Breakdown Structure for the Creation of a Virtual Enterprise

Successful creation of a virtual enterprise depends on detailed planning and evaluation procedures. Brokers systematically define a need, determine the feasibility of addressing that need, develop a system to respond to the need, and select partner organizations to perform specific functions of the system. In order to better understand the tasks performed in the creation process, a Work Breakdown Structure (WBS) is utilized (Figure 5.1).

A WBS is a procedure for dividing projects (in this situation, the project is virtual enterprise creation—see first level of Figure 5.1) into sub-elements or work packages. Work packages allow project managers to prepare schedules, estimate costs, and assign responsibilities. [Nicholas, 1994, p. 242] WBS's typically include dictionaries to explain the individual elements. A dictionary is provided with the WBS for virtual enterprise creation (see Appendix E).

The creation of a virtual enterprise requires three major work categories: 1) Feasibility Study, 2) Partner Selection, and 3) Contract (with partners). These categories are represented on the second level of Figure 5.1. Each of the categories play major roles in virtual enterprise creation. The first two are especially relevant to this paper and are the primary focus.
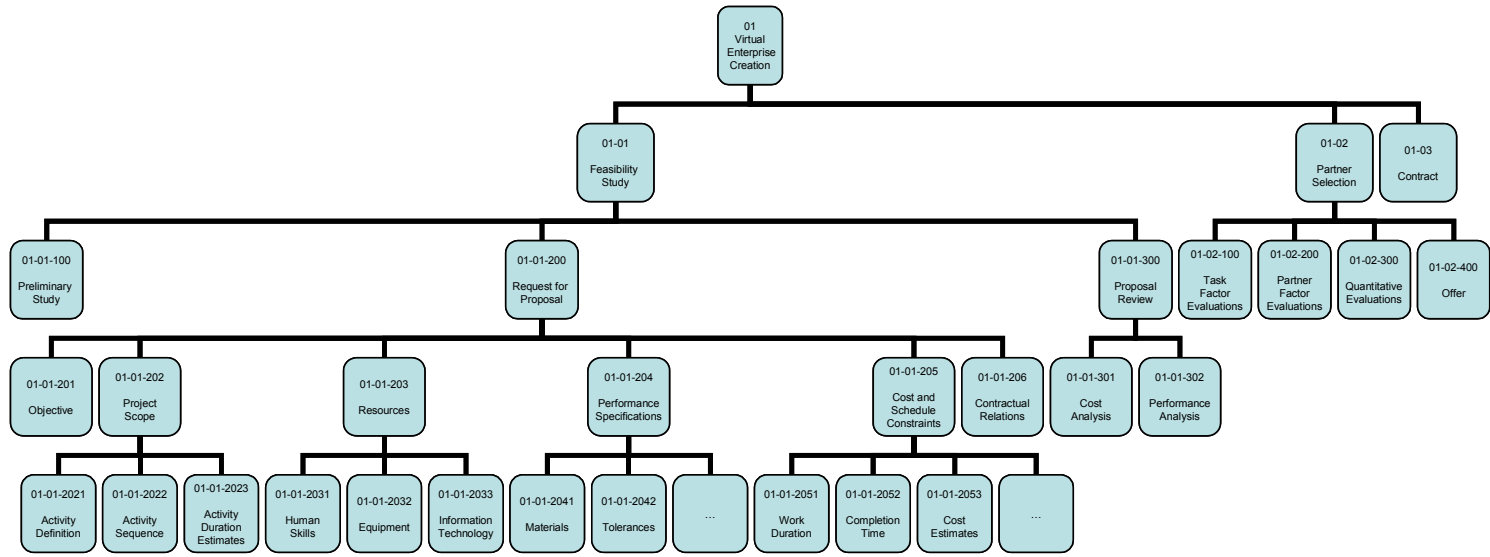
Figure 5.1: Work Breakdown Structure for the Creation of a Virtual Enterprise

5.5.1. Feasibility Study

The feasibility study is a combination of preliminary study, request for proposal, and proposal reviews. This combination is represented on the third layer of Figure 5.1.

5.5.1.1. *Preliminary Study*

The preliminary study is a brief study to determine the merit of an idea and the possibility of success. This study is not intended as a detailed part of the feasibility study. The request for proposal process and review of proposals allows for more in-depth analysis.

5.5.1.2. *Request for Proposal*

The RFP is a document to solicit work from potential partners. In order to prepare this document, it is important that virtual enterprise brokers use the systems engineering process to identify product and system requirements, the functions necessary to achieve the requirements, and constraints affecting achievement of the requirements. The RFP outlines this information and enables the contractor to submit a proposal to address the need. The major information provided in the RFP is represented on the fourth level of Figure 5.1. The fourth level concepts are broken down further to provide examples of specific information provided by the broker. Please note that these are subject to change (expand/contract), depending on the nature of the virtual enterprise.

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5.5.1.3. Proposal Review

The final element of the feasibility study (although feasibility analysis is a continual process—as discussed earlier) is that of proposal review. Potential partners submit proposals that outline the costs and work necessary to achieve the desired need. Brokers review the proposals as not only a means for determining potential partner decisions, but also to further define feasibility of the venture.

5.5.2. Partner Selection

Brokers base partner selections on a series of evaluations. It is important to evaluate potential partners from all possible aspects because success depends on creating a unified whole. Gunasekaran [1998] says that "coordination and integration are especially complicated under such an arrangement (referring to VE's). Successful attainment of the business goals of a virtual enterprise therefore depends on its ability to align the business process and practices of partner firms." Potential problems arising after partner selection include trust issues, motivation issues, communication issues, and cultural conflicts. In order to proactively address these problems, task factor evaluations, partner factor evaluations, and quantitative evaluations are utilized.

5.5.2.1. Task Related Factor Evaluations

Task factors are characteristics of the potential partner that relate to the specific task they will perform. Examples include knowledge of the local market and culture,

knowledge of the product environment, access to distribution channels, and political influence. [Arino, et al., 1997; Glaister and Buckley, 1997]

5.5.2.2. *Partner Related Factor Evaluations*

Partner factors are general characteristics of an organization that may determine the degree to which a positive and successful relationship will occur. Examples include reputation, professionalism, honesty, values, beliefs, and management approaches. [Arino, et al., 1997; Glaister and Buckley, 1997]

5.5.2.3. *Quantitative Analysis*

Quantitative analysis is a decision aid that determines a score for each partner's ability to meet the requirements specified by the broker. Each quantitative analysis tool differs, but the general objective is to determine a preferred or ordered list of potential partners. It should be noted that quantitative analysis is not a normal tool for partner selection. For examples of quantitative tools, see Hajidimitriou and Georgiou [2002], Ip, et al. [2003], and Talluri, et al. [1999].

According to Huang, Wong, and Wang [2004], today's conceptual and empirical models are often either too subjective or mathematically complex to be used in a practical manner. Current research needs call for simple, yet effective quantitative tools to support partner selection. These tools will become more commonly used as partner selection research progresses. Despite limited use, quantitative analysis is a potential step in the partner selection process. Therefore, it is included in Figure 5.1.

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5.5.2.4. *Offer*

Once partner selection decisions are made, broker organizations present offers for contract. Given the terms of the offer, an organization may or may not decide to accept the offer. Acceptance of an offer results in a contract between the broker and partner organizations. The contract is the final activity in the creation of a virtual enterprise. It is obviously not the final activity of the virtual enterprise. Post partnership activities include detailed design, production, distribution, and all other necessary activities of the virtual enterprise. Once the objective is achieved, the virtual enterprise disbands, and all assets are disbursed among the partner organizations.

Please note that the topic of partner selection is discussed in more detail as this paper progresses. Chapter 6 primarily deals with the topic of partner selection; however, other interface issues impact partner selection. These impacts will be discussed during the chapter for which they are addressed (e.g., task-related factor evaluations and partner-related factor evaluations are discussed in Chapter 7 – Culture.)

5.6. Conclusions

A system is composed of components that are related and perform specific functions in order to meet an objective. An example of a system is a virtual enterprise. A virtual enterprise is a temporary group of organizations that partner in order to address customer needs. Because virtual enterprises are man-made systems, brokers should use the systems engineering process to form the virtual partnerships. The primary application of

systems engineering to the formation of virtual enterprises occurs during the first two phases of the system life cycle—conceptual design and preliminary design. The third phase of the system life cycle—detail design and development—requires the partners of the virtual enterprise and the specialized knowledge they possess. Therefore, detail design and development primarily occurs after formation of the virtual enterprise.

This chapter also provides a work breakdown structure for the creation of a virtual enterprise. Work breakdown structures are useful tools for dividing projects into work packages. In order to properly create a virtual enterprise, it is important that brokers understand the tasks necessary to plan for and design the virtual enterprise system.

CHAPTER VI

PARTNER SELECTION

The dynamic nature of virtual enterprises increases their ability to quickly respond to the changing needs of the market, at least in theory. In reality, this increase is a function of how well the member organizations are able to integrate, coordinate, and align their processes and thereby efficiently and effectively provide a service or product. Gunasekaran [1998] says that "coordination and integration are especially complicated under such an arrangement (referring to VE's). Successful attainment of the business goals of a virtual enterprise therefore depends on its ability to align the business process and practices of partner firms." Camarinha-Matos, et al. [2001] concurs by saying that "to support a virtual enterprise, the involved organizations must be able to inter-operate and exchange a variety of information on-line, so that they can work as a single integrated unit with some common goals, while preserving their independence and autonomy."

Given that integration and alignment are vital factors, proper partner search and selection plays a vital role in determining the eventual success of a virtual enterprise. Lau and Wong [2001] agree by saying that "in particular, the process of searching for the appropriate partners is the key to successful formation of the virtual enterprise." They

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also point out (in reference to Reid, et al., 1996 and Goldman, et al., 1995) that the most crucial and timely aspect of creating a virtual enterprise is the process of searching for and identifying partners. [Lau and Wong, 2001]

The significance of proper partner search and selection deems it important for those establishing virtual enterprises to possess a basic set of requirements and measurements to consider when formally deciding on whether a given organization should become a member. These principles could then serve as an aid to the partner search and selection process with the expectation that a correlation exists between principle requirements and future success of a virtual enterprise.

Given below is a review of works that have been performed in the area of partner selection. Following this review is a discussion of the topic of supplier performance measurement. While supplier performance measurement is a tool for assessing the performance of current suppliers, it is logical that the same concepts can be used to assess the ability of suppliers prior to making a partnership decision. Therefore, virtual enterprise brokers should utilize the body of knowledge gained in the area of supplier performance measurement as a tool to aid in the partner selection process. A discussion of the relationship between measurement and supplier selection is provided.

6.1. Related Works

Past work in this area focuses primarily on the identification of factors for successful partner selection. These conceptual and empirical models are often either too subjective

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or too mathematically complex to be used in a practical manner. [Huang, Wong, and Wang, 2004] Current need calls for simple, yet effective quantitative tools to support partner selection.

Al-Khalifa and Peterson [1999] argued that the motivations for entering into joint ventures should be distinguished from the motivations for selecting partners. They surveyed forty-two international joint ventures in Bahrain and found that partner related factors were significantly more important than task related factors in terms of selecting partners.

Arino, et al. [1997] investigated partner selection and trust building in Western European and Russian joint ventures. In addition to exploring the contributions from partnering companies and management of the relationships, they looked at the criteria used to select partners. The criteria were both task and partner related. Task related factors included knowledge of the market conditions, knowledge of the environment, and political influence. Partner related factors included reputation, position within the industry, potential to maintain a continuing and stable relationship, professionalism, honesty and seriousness, enthusiasm for the project, and fit.

Geringer, et al. [1991] developed a typology of selection criteria by distinguishing between task and partner related criteria. Task factors are those involving operational skills and resources. Partner factors are those involving the effectiveness and efficiency of the partners' cooperation. They also developed a contingency approach to explain the weighting of task related criteria. They showed that the importance was related to three

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variables. 1) the degree to which the critical success factor would determine performance – positive relationship, 2) the degree to which the parent firm held the critical success factor – mostly negative relationships, and 3) anticipated future difficulty for a parent firm to achieve a competitive position on the critical success factor – positive relationship.

Glaister and Buckley [1997] identified important partner selection criteria through a sample of UK international joint ventures with United States, Japanese, and Western European partners. They separated the criteria into task related and partner related categories. The highest rated task related criteria included knowledge of the local market, access to distribution channels, links with major buyers, and knowledge of the local culture. The highest rated partner related criteria included trust between top management teams, relatedness of partner's business, and reputation. They extended the study by testing the relationships among the criteria and the following sample characteristics: partner nationality, industry of the joint venture, purpose of the joint venture, geographic location of the venture, initial approach for formation (i.e., which partner initiated the venture, and relative partner size). The study found that only geographical location of the venture considerably affects the importance of selection criteria.

Hajidimitriou and Georgiou [2002] used the goal programming technique to develop a quantitative model. The model uses appropriate criteria to evaluate potential candidates and leads to the selection of the optimal partner.

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Huang, et al. [2004] developed a two-stage framework for assisting in partner selection decisions. The first stage evaluates hard factors while stage two evaluates soft factors. Hard factors are those that have well-defined targets (e.g., time, quality, price). Soft factors are those that involve the potential relationship and cooperation of the partners and are difficult to place a specific target on (e.g., management, training, knowledge). The first stage identifies a short list from all potential candidates. Stage two produces a final recommended list.

Ip, et al. [2003] modeled a risk-based partner selection problem. Initially the inefficient candidate concept condensed the solution space. Next, a rule-based genetic algorithm with embedded project scheduling solved the problem with consideration for the characteristics of the problem and project scheduling knowledge.

Lau and Wong [2001] proposed an Optimized Partner Selection Scheme (OPSS) that consists of software programs (i.e., virtual agents) to accomplish specific tasks. They identified five types of agents that are critical to success: coordinating, communication, information, cyber search, and reporting. The coordinating agent receives requests of partners and distributes them to other partners as appropriate. The communication agent receives and sends messages in a quick and safe manner. The information agent uses knowledge from other agents to aid decisions. The cyber search agent assists with web searches to find, order, and analyze information desired by partners. The reporting agent gathers and distributes information needed to improve the operations of the virtual enterprise.

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Li and Rowley [2002] looked at relationships among US investment banks over a five-year period in order to examine whether previous ties affect partner alliance. They accomplished this by focusing only on partnership formations among companies with previous relationships. They found that both inertia and evaluation factors determine the degree of new engagements with former partners. They specifically showed that discrimination among past partners was based on reciprocity, experience relevant to the new partnership, and prior performance.

Luo [1996] simultaneously analyzed the effect of task or operation-related criteria and partner or cooperation-related criteria on the performance of international joint ventures (IJVs). He focused on six specific attributes: local firm identity (i.e., state owned or not), market share, industry experience, foreign experience, length of collaboration between partners prior to forming the IJV, and organizational size.

Talluri, et al. [1999] developed a two-phased quantitative approach to aid in selecting compatible partners. The first phase identifies a list of candidates for each process involved. The final phase determines the best arrangement of partners based on compatibility objectives through the use of an integer goal programming model.

6.2. Performance Measurement

There is an adage that "we can't manage what we don't measure." Supplier performance measurement is a technique used by organizations to better manage inputs and ultimately achieve customer satisfaction. Proper management, however, depends on

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proper measurements. Traditionally, supplier performance was based solely on pricing

issues. Lower prices are good, but not if total costs increase. Ayers, [2001, p. 199] states

that there must be a balance between the need for lowest price against the need for lowest

cost. For example, the lowest bid price may result in unseen quality and delivery

problems and ultimately higher overall costs. Because the total cost of ownership is

important, supplier performance measurement focuses on the aspects that drive total

costs. Although each supplier's situation is unique, there are certain categories of

measurements that are applicable to most situations. These include quality,

time/delivery, cost, responsiveness/flexibility, and supplier initiatives.

6.2.1. Quality

Customer expectations are continually increasing, and in order to remain competitive,

companies are placing increased demands for higher quality on suppliers. Products that

do not meet quality specifications result in waste, higher inventories to counteract waste,

higher *total* costs, and customer dissatisfaction. [Kuglin, 1998, p. 149] To measure a

supplier's quality level, certain key metrics are utilized. Examples of these include defect

rate, shipping damage, and warranty utilization. [Banfield, 1999, p. 237]

- Defect Rate- the proportion of parts/products ordered that do not meet specification limits (often measured in defects per million)

- Shipping Damage- the proportion of parts that do not meet desired quality levels due to damage during shipment

- Warranty Utilization- warranty utilization rates indicate overall product quality

6.2.2. Time/Delivery

Inventory costs (lost investment opportunities, taxes, insurance, obsolescence, and storage) drive organizations to minimize inventory levels. Minimal inventories magnify the importance of delivery. Late shipments can have a profound impact on the supply chain, bringing production lines to a halt. In addition to the impact of late deliveries, late deliveries themselves may be an indicator of deeper problems that will escalate in the future if not properly addressed. In an effort to manage delivery performance, certain standard measurements are taken. Kuglin, [1998, p. 72] says that the standard measures for determining quality deliveries include on-time deliveries and order fill rate. Another major measurement is that of order lead-time. [Bowersox, et al., 2002, p. 75]

- On-Time Deliveries- the proportion of orders delivered on or before the requested date
- Order Fill Rate- the proportion of orders shipped complete as ordered
- Order Lead-time- the average time from the date an order is placed until the customer receives shipment

6.2.3. Cost

Cost is the most direct measurement of supplier performance. Cost performance is primarily measured in terms of the total amount spent on a specific function. It is also common to use cost measures such as cost as a percentage of sales or cost per unit of

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volume. These measures, when compared to historic levels or standard costs, provide opportunities for identifying areas for improvement. Cost management measurements are also key cost indicators. These concepts are further discussed in section 6.2.5: Supplier Initiatives.

6.2.4. Responsiveness/Flexibility

Customers are not always predictable. They often present unusual or unexpected requests, and they even may request changes to their original demands. Responsiveness is the ability to react positively to customer desires and changes. In order to ensure competitiveness, suppliers must respond within appropriate time frames. [Stadtler and Kilger, 2002, p. 34] Bowersox, et al. [2002, p. 76] outline seven typical events that require flexibility: 1) modification to basic service agreements, 2) support of unique sales or marketing programs, 3) new product introductions, 4) recalls, 5) disruptions in supply, 6) unique customization of basic service for specific customers, and 7) product modification or customization such as price-marking or packaging. Examples of measurements for responsiveness/flexibility include order lead time (also a time/delivery measurement), upside production flexibility, and downside production flexibility.

- Order Lead Time- the average time from the date an order is placed until the customer receives shipment

- Upside Production Flexibility- the number of days needed to adapt to an unexpected 20% growth in demand [Geary and Zonnenberg, 2000]

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- Downside Production Flexibility- the percentage order reduction sustainable at 30 days prior to delivery with no inventory or cost penalty [Banker and Snitkin, 2003]

6.2.5. Supplier Initiatives

Part of the ability to manage supply chain costs includes suppliers identifying, measuring, and modifying cost drivers within their organizations. [Underhill, 1996, p. 52] In addition, the key to continuous improvement is the ability to find suppliers who are aggressive in identifying opportunities to improve their performance. [Underhill, 1996, p. 61] The *supplier initiative* category of supplier performance measurement is more subjective when compared to the other categories. Despite this, it is very important. Supplier initiatives include concepts such as the implementation of continuous improvement and quality control initiatives. For example, many organizations use methodologies such as Statistical Process Control (SPC) or Six-Sigma to improve quality and many seek ISO certification for their processes. Another example of a supplier initiative is the desire to provide courteous, meaningful, and timely communications. In a supply chain, communications are vital to effectiveness. In fact, Lynch [2000, p. 94] states that "poor communication is second only to poor planning as a major cause of outsourcing relationship failure." Finally, supplier initiatives include cost management and reduction strategies. Examples of cost management/reduction strategies (other than the quality improvements discussed earlier) are lead-time reduction, no restocking fees,

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consigned inventories, and invoice accuracy. [Kay, 2005] These types of initiatives provide purchasing organizations with evidence that their suppliers are committed to increasing quality and reducing costs.

6.3. Advantages and Limitations of Measures

Supplier performance measures are useful evaluation tools. They provide organizations with: 1) a direction in which to set priorities, 2) a gauge for progress, 3) key issues on which to stay focused, 4) indicators for areas that need attention, 5) a way to initiate communication with partners, and 6) a basis for measuring and rewarding people and teams. [Ayers, 2001, p. 417] Despite these advantages, several limitations exist. First, measures may indicate that something is wrong, without identifying what is wrong. Further investigations are needed to understand root causes of problems. Second, the indicators are retrospective and are not capable of anticipating future developments (e.g., customer behavior). [Stadtler and Kilger, 2002, p. 36] Third, there are often trade-offs between the measurements. For example, speed of service is often costly. Certain customers may not want extra speed if it increases costs. [Bowersox, 2002, p. 74] Fourth, a focus on local improvements (e.g., costs) may increase the total supply chain costs. [Kuglin, 1998, p. 211] Finally, *on average, over time* measures tend to disguise real impacts on the customer base. For example, a 99.5% on-time delivery really means that 1 out of every 200 customers are not satisfied. [Bowersox, 2002, p. 562]

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6.4. Which Measurements to Use / Importance of Measurements

It is important to utilize metrics to monitor supplier performance. Collecting, analyzing, and reporting data, however, is expensive. Therefore, measurements that are chosen should be based on identified needs and used to drive improvement. [NRC, 2000, p. 41] Kuglin [1998, pp. 80-81] states that for supply chains to perform at a world-class level, they must listen to customer needs and subsequently measure performance in terms of those needs. In other words, the *what to measure* cannot be decided until one understands *why to measure*.

The process of determining proper supplier measurements is essentially based on the systems design process. That is, needs are identified and progressively built into a system at more detailed levels. The same is true for proper use of supply chain measurements. The first and most important step is to determine what areas or needs are important and should be measured. Ayers [2001, p. 50] states that the voice of the customer determines the needs or areas in which the supply chain is to excel. Once these needs are identified, they must be designed into the supply chain through measurable standards. [Kuglin, 1998, p. 80] The designed measurements then serve as a determining factor in setting priorities, gauging progress, focusing on key issues, and facilitating communication—all in order to drive improvement in the eyes of the customer.

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6.5. Indirect/Service Suppliers

Indirect and service suppliers' performance is becoming increasingly important as a part of the supplier management task. One reason is that some companies are incurring indirect spending amounts as much as 50% of total expenditures, and indirect spending is projected to grow around 5% per year for the next five years. [Mazel, 2004] Because of the difference between manufactured products and services, organizations often place different degrees of importance on different areas of measurements. These areas often include contract compliance, customer satisfaction, cost competitiveness, and continuous improvements. Example metrics utilized in these areas are given below. [based on Mazel, 2004]

Contract Compliance
- Cost versus Budget- did the supplier perform over or under budget
- Performance Against Service Level Agreement- how does the supplier deliver relative to the service level agreement
- Return Rate- how many and how often are items returned
- Order Invoice and Accuracy- are correct orders received and priced as quoted

Customer Satisfaction
- Customer Service
- Technical Support

Cost Competitiveness

- Supplier Pricing versus Industry Average

- Supplier Pricing versus Other Benchmarks (e.g., other supplier quotes)

Continuous Improvement

- Cost Reduction Targets

- Cost Reduction Recommendations

- Partnership Initiatives

6.6. Performance Measures and Partner Selection

Potentially, any number of organizations is capable of performing the processes that another organization has decided to outsource. The reason that organizations outsource, however, is to allow their organization to focus on the key processes that they perform best and contract out the remaining processes to organizations that specialize in those areas. The key processes that organizations specialize in are known as core competencies. That is, core competencies are the two or three value-added activities that separate an organization from its competitors. [Strader, et.al., 1998, Bottoms, 1994] When outsourcing, it is desirable to determine which organizations hold the core competencies that are needed. This serves as an initial factor for reducing the potential number of suppliers. [Kuglin, 1998, p. 227] Once the short list of candidates is determined, more in-depth methods are needed to evaluate an organization's ability.

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Performance measures provide tangible information to assess the ability of an organization to meet certain desired outcomes. In fact, certain essential requirements advocated for supplier selection are the same primary categories used for supplier measurement—quality, cost, delivery, response/flexibility. [Li, et al., 1997, Talluri, et al., 2002; and Jain, et al., 2004] As mentioned previously, the needs of a supply chain originate with the ultimate end-user. From a systems perspective, these needs are to be designed into the system that is used to produce the end product or service. The system is the supply chain itself. However, sub-systems of the supply chain are the individual partners. For the supply chain to meet customer requirements, each partner and the functions they perform must be able to meet certain identified requirements. These requirements are manifested in the form of performance measurements. Therefore, proper partner selection (i.e., proper design of the supply chain) depends on finding partners that are capable of meeting these measurements.

6.7. Using Measurements to Compare Potential Partners

In order to calculate the supplier's performance score, three primary steps are needed. First, the general categories for measurement and weights for each category must be decided. For example, a company may decide to measure quality, time/delivery, price, and supplier initiatives. Once these are determined, the organization must determine the importance of each category and weight each factor accordingly. These weights, as mentioned previously, are driven by customer desires and thus the organization's overall

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business strategy. In this example, the organization might decide to use weights of 35%(quality), 30% (time/delivery), 25% (price), and 10%(supplier initiatives). The second step is to determine the specific measurements for each category and the weights that they carry within the category.   The final step is to determine the score for each category and the overall supplier performance score. Based on the measurements, suppliers are scored on a common scale (often 0-100) within each category. Once the categorical scores are determined, each score is multiplied by its respective weight and the sum of these products is determined. For example, consider the above categories receiving scores of 85, 90, 95, and 80, respectively. The supplier performance score: $85*.35 + 90*.3 + 95*.25 + 80*.10 = 88.5$. The score indicates the level at which suppliers are performing. The evaluating organization determines the range of scores for each level of performance.

6.8. Partner Pooling

Virtual enterprises typically end once the objective is accomplished. The companies that contributed to the virtual enterprise may continue as an ongoing network capable of providing resources as needs arise in the future. [Weisenfeld, et al., 2001] Lau and Wong [2001], in reference to Goldman, et al. [1995], discuss a similar concept. They distinguish (unlike most authors) between virtual enterprises and virtual organizations. They state that a virtual organization is an alliance of organizations, and the virtual enterprise forms when any number of the organizations in the alliance partner for a

particular need. They continue and say that the relationships between virtual enterprises and virtual organizations are beneficial because: 1) members of the virtual organization are recommended by other members and qualified through assessments, 2) partner selection is more efficient because there is no need for random, world-wide searches, and 3) the flow of information and material transportation is often greatly improved. [Lau and Wong, 2001]

Partner pooling is a common concept. From children choosing teams in kickball to construction companies determining sub-contractors, we often have a predetermined mindset of ideal parties for partnership. Recommendations, past relationships, and reputation contribute to this mindset. The dynamic nature of virtual enterprises provides for many unique relationships between partner organizations. Instead of totally cutting ties, organizations may maintain a certain degree of contact and harness the advantages provided by a loose, ongoing network.

CHAPTER VII

CULTURE

Organizations, as with other segments of society, have central beliefs and expected norms of action. Cultural differences among organizations often create barriers to the development of virtual enterprises. According to Hartmann and Guss [1996], discussion of these barriers lacks the attention received by the literature touting the technological capabilities utilized to solve organizational problems. Despite the lack of attention, virtual enterprise success depends on properly addressing the psychological hazards of adjusting to new cultures. [Chandler, 1962; Hartmann and Guss, 1996] Cultural differences affect communication and trust among parties as well as motivation and should play a key role in partner selection decisions.

Cultural communication barriers include differences in language, terminology, and frequency and means of communication. The geographic distance between member organizations often leads to language differences (especially for global virtual enterprises) but more frequently communication is affected because organizations tend to have differences in expressing themselves (e.g., differences in terminology). Virtual organizations must learn to deal with these social aspects of communication. In addition, they must learn to communicate in means other than face-to-face interaction. Individual

organizations often favor one form of communication over another. Mixing these preferences presents opportunities for conflict. This is especially true for conservative or risk-averse cultures that often resist new and unfamiliar means of communication. [Hartmann and Guss, 1996]

Cultural differences play a key role in motivation levels. Organizations approach motivation in their own manner. Some are more successful than others. Some are happy with the status quo, while others are driven to reach new heights. Task specificity also plays a key role in motivation: member organizations that are contracted for a specific purpose may or may not be motivated, depending on the importance placed upon the task itself.

Along similar lines to communication and motivation are trust issues. The extent to which trust exists affects the degrees to which effective communication and motivation are present. Decision-making capabilities, values, beliefs, and other differences that exist among organizational cultures affect trust between members of the virtual enterprise.

Culture plays a large role in the virtual organization's ability to communicate, trust, and motivate. Understanding these issues will better position the virtual organization to address specific needs and spur success in the ever-changing virtual environment. A better understanding of organizational culture should play a key role in partner selection, which in turn proactively addresses and avoids potentially damaging future conflicts. Bartlett and Ghoshal, [1996], in Hartmann and Guss, [1996], state that there is no organizational context in the virtual setting. The result is that the individual forces that

drive each member "may result in team fragmentation, isolations and inter-unit competition, and blockages in the flow of knowledge." [Hartmann and Guss, 1996, p. 187] Success depends on appropriately facing these cultural dilemmas.

7.1. Use of the Literature on Mergers

Because the literature devotes little focus to the effect of culture in the virtual environment, the literature from a related field is utilized to address how virtual enterprises potentially overcome associated issues. The field is that of mergers. A merger is the consolidation of two or more organizations into a single organization. The relatedness of these situations should provide fertile areas for application in the virtual environment.

7.2. Defining Culture

Every organization possesses its own culture: each has shared values that distinguish it from other organizations. These shared values are important because they provide "continuity, structure, common meaning, and order." [Schulz, 2001] Schulz continues by stating that culture helps drive success because it focuses employees on the company mission and the manner in which it is to be achieved. It also emits a religious quality that attracts employees who fit in and deters those who do not. [Schulz, 2001]

According to Robbins [1998], cultural differences revolve around seven primary characteristics: innovation and risk taking, attention to detail, outcome orientation, people orientation, team orientation, aggressiveness, and stability. Roger Miller [2000]

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states that culture includes factors such as: how customers, suppliers, and fellow employees are treated; decision making (participation, level, speed, and process); formality and controls; performance rewards; risk tolerance; and cost and quality orientation. Based on a review of a number of authors, Reigle [2001] says there are five factors of culture: language, tangible artifacts and symbols, patterns of behavior rites and rituals, espoused values, and beliefs and underlying assumptions (rendered in management decisions, policies, and procedures). Schein [1996], views culture from three perspectives:

    1) assumptions – taken for granted beliefs,

    2) values – shared beliefs and rules, and

    3) artifacts – things that are visible such as language, behaviors, and material symbols.

7.3. Types of Cultures

Just as individuals have different types of personalities, organizations possess different cultures. William Schneider identified four distinct types of organizational culture: control cultures, collaboration cultures, competence cultures, and cultivation cultures. Each possesses a different approach to strategy, leadership, and organizational behavior. [Schneider, 1994; Schulz, 2001]

- Control Cultures – predictable and orderly, authoritative and conservative

- Collaboration Cultures – close relationships with customers, desire high participation and cohesive teams

- Competence Cultures – innovative, visionary, set high standards, encourage higher levels of achievement

- Cultivation Cultures – strive for life enrichment, inspirational and charismatic leadership

Moorman, et al. [1993], (in reference to Deshpande, et al. [1992]) discuss four similar types of cultures, albeit with different labels.

- Hierarchies – characterized by order and efficiency

- Clans – characterized by teamwork, cohesiveness, and participation

- Markets – characterized by achievement of goals and competition

- Adhocracies – characterized by creativity, adaptability, and entrepreneurship

Reigle [2001], in reference to Burns and Stalker [1961], describes cultures as being mechanistic or organic. Mechanistic structures are favorable for stable environments while organic structures are better suited for changing and innovative environments. Table 7.1, from Reigle [2001], portrays the characteristics of each structure.

Table 7.1: Characteristics of Organic and Mechanistic Cultures

Organic Characteristics	Mechanistic Characteristics
Little emphasis on chain of command	Close adherence to the chain of command
Divisional-type division of work	Functional division of work
Continually adjusted job definitions	Specialized task
Lateral communication	Vertical communication
Employee commitment to the organization's tasks	Top-down decision making

7.4. Strong and Weak Cultures

In addition to determining specific types, cultures can be identified as strong or weak. The strength of a culture depends upon the degree to which underlying beliefs and values are shared. The implication is that cultures are not meant to change, especially strong ones. Thus, successful pre-merger performance accompanied by a strong culture does not guarantee post-merger success. [Cartwright and Cooper, 1993; Schraeder and Self, 2003]

7.5. Examples of Bad Cultural Fits

Culture influences a person's commitment, motivation, productivity, and satisfaction. The cultural differences among member organizations logically influence the operation of the virtual enterprise. [Arino, et al., 1997]. Despite the influence, organizations do not devote a proportionate amount of attention to the effect culture will play on the partnership. Estimates indicate that between 55-70% of mergers and acquisitions fall short in reaching initial purposes. [Carleton, 1997; Schraeder and Self, 2003] A sample of mergers that failed to meet objectives include:

- AOL and Time Warner- a major drop in stock price compared to the price of each company's pre-merger prices

- Daewoo Motors and acquired companies in Romania and Poland- lost $540 million in 2000

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- Mansanto and American Home Products- a $35 Billion merger that failed
- Price Club and Costco Wholesale- a 1993 merger potentially capable of competing with Sam's Club, that failed

The degree to which mergers and acquisitions fail is quite high, and the reasons for the high failure rate are numerous. A potential leading factor, however, is problems in cultural integration. [Yen and Liao, 2003] Cultural integration is a task for both pre and post partnering.

7.6. Pre-Partner Selection Assessment of Cultural Compatibility

The joining of different cultures will always result in some degree of difficulty. Examples of cultural clash include conflicting roles, an unclear transformation process, the lack of integration strategies, poor communication, and underestimating the need for guidance and support. [Price, 1999, Horwitz, et al., 2002] Assessing the degree of potential clashes between possible partners will better prepare partners to meet the difficulties and increase the probability for success. This insight creates an understanding of the strengths and weaknesses of each partner's management teams, helps determine an appropriate organizational structure and the need for redesign, provides an awareness to the probability of reconciliation of differences, and identifies issues that could place the partnership at risk. [Horwitz, et al., 2002] Organizations who fail to develop this insight open the door for implementation difficulties [Olie, 1994] and vulnerability. [Reigle, 2001]

7.6.1. Key Areas for Assessment

Miller [2000] suggests paying attention to the following issues during a cultural valuation process: management approach, budget and projections, conventions for long range planning, management reports and reporting procedures, organizational and human resource structures, manufacturing and procurement processes, engineering and research and development infrastructure, and corporate values.

Horwitz, et al. [2002], concurs by saying that key features of a cultural audit include understanding the strengths and weaknesses of management, reviewing existing human resource practices and systems, and identifying the needs/opportunities for organizational restructuring and redesign.

Mirvis [1985], in Schraeder and Self [2003], highlights four key assessment areas: top management relations (reporting, decision making, flexibility), compatibility of business systems (i.e., technological infrastructure), cultures that support integration, and mutual goals desired through the integration.

7.6.2. Other Considerations During Assessment

In addition to considering the compatibility of cultural elements, Olie [1994] suggests performance is based upon three other factors: the type of merger combination, the degree to which parties value and want to retain their organizational integrity, and whether the organizations' relationships are symmetrical or asymmetrical.

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Merger combinations range from minimal to maximum. Partner firms that are more or less autonomous characterize minimal combinations. The primary areas affected during implementation of minimal combinations are those of strategy related decisions. Partnerships that are highly interactive are considered to be on the maximum end of the scale. These affect internal management and the companies' relationship with the environment. Due to this, there is a greater need for compatibility of the companies (i.e., focus of authority and responsibility, personnel policies, and decision making styles).

Power differences are a major problem during the integration of cultures. Problems will be minimized if the new organizational identity is favorable and any power differentials are accepted and seen as legitimate.

Symmetrical relationships are those that are on equal terms with neither party having the power to impose its frame of reference on the other. Thus, a third culture has to be developed, and the potential for difficulties is increased. Asymmetrical relationships utilize a dominant-subordinate partner relationship to instill a common frame of reference.

Organizations that assess the cultures of their potential partners mitigate a portion of the risk associated with virtual enterprises. Schraeder and Self [2003] articulate that "it is logical that the success rate of mergers and acquisitions could be enhanced through incorporating cultural compatibility into the identification, evaluation, and assessment and selection of potential partners."

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7.7. Post-Partner Selection Cultural Considerations

Effective cultural assessment along with ideal partner selection will not totally eradicate the need for cultural integration. Even compatible cultures need to insure that each party is indoctrinated into the new virtual culture. These post-partnering integration considerations include effective communication, goal setting, incentives and control systems, socialization activities, and credible leadership.

7.7.1. Communicating for a Successful Partnership

Communication is the vehicle that transmits cultural expectations throughout the virtual enterprise. [Grabowski and Roberts, 1999] Interface communication is vital and should encompass all aspects of organizational culture. These include all values, beliefs, processes, rationales behind decisions, roles and responsibilities, and managerial expectations. In a poll of 218 companies in the United States, approximately forty-four percent of those in mergers said that their companies failed to devote enough resources to communication. Fifty-seven percent of those same companies surveyed said that employee communication was a crucial factor and essential to integration success. [Gillam, 1998] Horwitz, et al. [2002] agree in saying that effective cultural integration depends upon the development of employee morale, motivation, and trust – all of which are a direct effect of properly communicating expectations and the effects of changes within the organization. Schweiger and DeNisi [1991], in Schraeder and Self [2003],

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recommend that communication to employees about the effect of integration occur as soon as possible. Proper communication of expectations, however, depends on senior management understanding merger strategy and communicating it to those involved in planning and integration. [de Camara and Renjen, 2004]

7.7.2. Goal Setting for a Successful Partnership

de Camara and Renjen [2004] state that a majority of successful mergers begin from a vision of how the partnership will produce synergies (increased market share, revenues, etc.) that would not be possible individually. This vision leads to strategies, objectives, and goals. Miller [2000] states that culture is how things are done, but strategy shows what is to be done. The awareness of these common objectives and means for achieving them reinforces cultural integration and stimulates the partner organizations to see themselves as a unique entity. Thus, they are transformed from an *us* and *them* perspective to a *we* perspective. [Olie, 1994]

7.7.3. Incentives and Control Systems

Incentives and control systems greatly impact the alignment of organizational behavior with the virtual enterprise's goals and culture. [Grabowski and Roberts, 1999] Organizational rewards that encourage individual competition will not promote the desire for virtual teamwork. There must be an alignment of incentives and desired behavior.

7.7.4. Socialization Activities

Larsson and Lubatkin [2001] argue that harmonious integration of various cultures depends on participation in social controls. Social controls are informal, non-authoritative activities that promote the development of a joint culture. Examples include transition teams, task forces, introduction programs, training, celebrations, and other similar activities. Larsson and Lubatkin [2001] add that neglecting such social controls and trying to force acculturation through conquering activities will cause resistance. Schraeder and Self [2003] agree that socialization activities are a necessity in melding cultures. They add, in reference to Gundry and Rousseau [1994], that members should be kept up to date through cross-functional seminars provided by supervisors. In reference to Marks and Mirvis [1992], Schraeder and Self [2003] also promote the use of ceremonies to symbolically represent that members are moving on to new territories.

7.7.5. Credible Leadership

The virtual enterprise is an entity in itself. The leadership of the entity possesses the power to influence commitment, motivation, and trust. Leaders must symbolize the new identity. Both verbal actions and physical behaviors of those in leadership positions set the precedent for norms. These norms filter down through the organization and affect the overall culture of the enterprise. A good example of how leaders impact culture can be seen in the changing culture of Xerox (based on leadership from 1961 to 1999). From 1961 to 1968, the company possessed a bold, informal, innovative, risk-taking

environment under Joseph C. Wilson (an aggressive entrepreneurial type). From 1968 to 1982, Xerox had a formal, political culture under the leadership of C. Peter McColough (a Harvard MBA recipient with a formal management style). From 1982 to 1990, David Kearns led a Xerox company that pushed decision making downward and rewarded quality and efficiency. Kearns successor, Paul Allaire, re-arranged the organization around a global marketing department in hopes of developing innovative thinking and out-working competitors. [Robbins, 1998]

CHAPTER VIII

TRUST

Trust implies a faith in the ability of others despite the possibility of disappointment. Hosmer [1995, p. 399] defines trust as the "expectation by one person, group, or firm of ethical behavior – that is, morally correct decisions based upon ethical principles of analysis – on the part of the other person, group, or firm in a joint endeavor or economic exchange." Certain factors affect the degree of trust which affects relationships with others. Trust is a staple to the ability to work with others. Teamwork requires the sharing of information, the ability to cooperate, and the reliance on others to deliver on their commitments – none of which are possible without some level of trust.

Dependence on others is necessary to function within an organization. Virtual enterprises invoke this to an even higher level because co-workers often know little to anything about one another. Imagine meeting someone for the first time. Now imagine sharing personal / private information with that person. How would your level of trust rate on a scale of one to ten? Low? Why? This is because trust often builds (or erodes) with time. Quick trust is not ideal, yet this is what is asked of the members of a virtual enterprise. Companies often share information with members who may one day become the competition.

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The fact that control and hierarchy are often absent in virtual settings makes trustworthiness an even more important characteristic. [Kasper-Fuehrer and Ashkanasy, 2001] Management approaches must change to address issues that extend beyond their organization's brick walls. This entails a reduction in power and authority and an increased need to rely on partners. Though this reliance is necessary, ill-advised trust can lead to loss of control and failure of the virtual enterprise, if not the individual organization itself (i.e., a key reason partner selection is important).

8.1. Developing Trust

Trust is an essential part of a successful virtual organization. It is often referred to as the glue that holds the network together. [Pihkala, et al., 1999; Thorelli, 1986; Larson 1991, Blomquist, 1994; Sanner, 1997]. Trust allows one to concentrate on the mission without worrying about partner responsibilities. [Grabowski and Roberts, 1999] It affects performance, innovations, profits, and customer relationships. [Keyzerman, 2003] Virtual partners must, therefore, take steps in order to develop a trusting relationship.

Humans develop relationships and trust through frequent interactions, communication, and mutual values. Similarly, the relationship development process can be related to the development of trust in virtual enterprises. [Lewicki and Bunker, 1995; Jarvenpaa and Leidner, 1999]. The problem is that virtual enterprises enter into relationships quickly and often do not have an appropriate amount of time to develop a fully trusting

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relationship prior to partner selection. Therefore, companies must exhibit certain characteristics of trust early in the virtual enterprise life cycle and, once selected, take the necessary steps to develop and maintain trust.

8.2. Pre-Partner Selection Factors of Trust

The broker of a virtual venture selects partners based on a specified need. Selecting among potential candidates necessitates some level of trust. Factors of early trust are direct/former relationships, reputation, task importance, business values/ethics, and appropriate information technology.

8.2.1. Direct/Former Relationships

A first-hand, working knowledge presents the ideal case for assessing the abilities of others. In addition to abilities, other key insights are gained that lead to a deeper level of trust (or lack thereof) that is not available where no prior relationship occurred. In fact, previously successful relationships serve as building blocks for even more in depth trusting relationships [Gounaris, 2005] because there is a heightened ability to interpret the true intentions of another party. [Rampel, et al., 1985; Gounaris, 2005]. The length of time between working with another company is a key factor that must also be considered. Changes in an organization's leadership, structure, culture, objectives, etc., are all possibilities as time passes. The degree to which these changes occur will affect the level of initial trust that one company has for another.

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8.2.2. Reputation

Companies that do not have first hand knowledge of another organization can obtain an initial level of trust because of indirect relationships. Reputation influences trustworthiness. [Ganesan, 1994; Gounaris, 2005] For example, company A knows company B which knows company C. Company A, while not knowing company C, is more willing to work with company C because of a recommendation from a company with which it has a trusting relationship (company B). In addition to indirect relationships, a company's reputation may precede them due to popularity in the marketplace because of the quality and cost effectiveness of their processes/products.

8.2.3. Task Importance

Trust is based on the risk of an undesired outcome. Trust is not needed when there is the absence of the potential for an undesired outcome. [Johnson-George and Swap, 1982; Kee and Knox, 1970; Mayer, et al., 1995] Entrusting very important tasks to other companies requires a commensurate degree of trust. Entrusting tasks that carry little importance requires lower levels of trust. Mayer, et al. [1995] agree by defining trust in terms of willingness to be vulnerable: "(trust is) the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control the other party."

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8.2.4. Common Business Values/Ethics

Kasper-Fuehrer and Ashkanasy [2001] state that a necessity for building trust is the establishment and maintenance of a common business understanding and ethical standards. The establishment of a common business understanding requires the creation of clear product specifications, a specification about the level of cooperation (deadlines, liability, profit allocation, etc.), and a formal specification of the agreement between partners. The meeting of these specifications stimulates the development of mutual goals, a willingness to work together and share information, and the creation of interpersonal trust. [Kasper-Fuehrer and Ashkanasy, 2001]

Hosmer [1995], in Bell, et al. [2002], based on a study of numerous definitions of trust, agrees on the importance of values. He says that ethics are integral to trust. Merriam Webster [MWOD] defines ethics as "the discipline dealing with what is good and bad and with moral duty and obligation." Ethical standards, therefore, serve as a governing influence. The problem is that virtual enterprises are composed of various cultures. The ethical standard in one culture may be unethical in another. Cultural assessment of values and ethical standards are important and should play a key role in the initial level of trust used to determine appropriate partners.

8.2.5. Appropriate Information Technology

Information technology (IT) is the primary reason that virtual enterprises are possible. IT provides a link between geographically separated individuals who otherwise would be

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unable to effectively network to achieve a common goal. Certain key issues still limit IT, despite the advancements available today. These issues include reliability, security, and compatibility. Please refer to chapter 9 for a discussion of the role of IT and these key issues.

8.3. Post Partner Selection Factors of Trust

Trust is a characteristic that will increase or erode with time. Member organizations should take the necessary steps to insure that the initial trust present in forming the enterprise is built upon and used as a catalyst for success. In order to accomplish this, the following factors should be addressed: contractual relationships, communication, decision-making / conflict resolution, shared objectives, and cooperative attributes.

8.3.1. Contractual Relationships

Branzei, Vertinsky, and Camp [2003] suggest that two areas of contracts influence future behavior: specificity and flexibility. Specific contracts state expected behaviors and the punishment for unexpected behaviors. Flexible contracts permit the overlooking of contractual terms for the sake of maintaining relationships. Individualistic cultures favor strong legal sanctions and feel that they foster trust and credibility. Collectivist cultures favor flexible contracts because they depend on social ties to provide what is known as moral controls.

8.3.2. Communication

Jarvenpaa and Leidner [1998] discuss a concept of swift trust (initially developed by Meyerson, et al. [1996]) among global virtual teams of a finite lifespan that develop due to clear purpose. Jarvenpaa and Leidner [1998] state that trust is facilitated by both communication and member actions that take place early and later on in the group's life. They say that trust develops early in group life because of social communication (discussing activities, hobbies, etc.) and communication that conveys enthusiasm about completion of the task at hand. Early member actions that facilitate trust include coping with technical and task uncertainty and members showing individual initiative (suggestions, volunteering, etc.). Trust is maintained later on in the group's life by predictable communication and by substantive and timely responses. Finally, member actions that maintain trust beyond the early stage of a group's life include leadership, transition from a procedural to task focus, and phlegmatic responses to crisis.

8.3.3. Decision Making / Conflict Resolution

Team members that make decisions without the input of the group create doubt as to the intent behind the objective. This is especially true when the decision differs from the opinion of other group members. Even a decision congruent with a similar opinion can result in problems for people who have not been consulted. A virtual enterprise is a team of individual organizations; individual organizations that make un-consulted decisions affecting the whole network produce trust related problems. While decision-making by

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consensus can increase the time needed, it brings the attitudes of each partner closer together. [Arino, et al., 2001]

8.3.4. Shared Objectives

Mutually defined missions, strategies, and objectives create beneficial situations for all participating parties. Shared objectives create ownership and motivation (section 10.4.1 provides more on this topic). In addition to motivation, shared objectives play a key role in trust development. Suchan and Hayzak [2001] say that trust requires shared purpose and goals. Keyzerman [2003], in reference to Lipnack and Stamps [1997], express that virtual teams need purpose and action toward the purpose. Developing a mutual purpose necessitates debate and reflection – strengthening unity and trust. Trust continues to grow beyond the development of shared objectives. Once objectives are developed, members interact to complete tasks, understand problems, establish effective patterns of communication, and deepen trust levels. [Suchan and Hayzak, 2001]

8.3.5. Cooperative Attributes

The cooperative nature of the virtual enterprise opens the door for company-specific and individual-specific characteristics to emerge. Each of these characteristics relate to how well members work together. The presence or lack of certain cooperative components influences the degree of trust between parties. Swan et al., [1988] researched how industrial sales people won customer trust. They found that five key components affect trust: dependability, honesty, competence, customer orientation, and

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likeability. Similar findings are identified throughout trust-based literature for customer-supplier relationships. Given below is a sample of these findings. Note that each of the trust concepts identified in these findings logically relates to the concepts identified by Swan et al. [1988].

Mayer, et al. [1995] stated that trust is built around three dimensions: ability, benevolence, and integrity. Jennings [1971] identified loyalty, accessibility, availability, and predictability as factors of trust. Gabarro [1978] pinpointed nine factors of trust. These include business sense, consistency of behavior, discreetness, functional/specific competence, integrity, interpersonal competence, judgment, motives, and openness.

Butler [1991] identified competence, consistency, discreetness, fairness, integrity, loyalty, openness, promise fulfillment, and receptivity.

CHAPTER IX

COMMUNICATION

Communication is simply the exchanging of information. One must effectively

convey ideas in order to communicate clearly. Effective conveyance often includes

verbal as well as non-verbal cues. Face to face communication allows parties to see and

hear the non-verbal and verbal cues. Even so, communication is not always ideal. At the

other end of the spectrum are one-to-many and many-to-one communications between

parties that are physically separated. Barriers to effective communication arise at even

higher rates in these situations because of the potential lack of verbal and/or non-verbal

cues and because of the geographically distributed parties. Such is the dilemma with

virtual enterprises.

Time also impacts communication in the virtual environment. Virtual enterprises

develop quickly and disband once goals are met. This quick and temporary nature

provides many advantages yet also degrades the ability to ideally communicate.

Specifically, three major communication concerns (all related) arise: social concerns,

organizational / management concerns, and technological concerns. [Keyzerman, 2003]

The social side of communication is the development of ways to understand one another.

The organization / management side deals more specifically with the operation of the

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virtual enterprise (achieving vision, goals, objectives, etc.). The technological side is the cooperation among partners' respective information technology (IT).

- **Social**

Virtual enterprises heavily depend on electronic forms of communication. Such reliance produces several negative effects, especially from a social standpoint. A primary drawback is that it takes longer for parties to form impressions of each other. The result is that relationships are hard to build. [DeSanctis and Monge, 1999] Therefore, the ability to trust is impeded and conflict resolution is hindered.

People worry about what to include in e-mails because they fear the information will not remain confidential. Another social problem is that e-conversation styles may not mesh due to differing backgrounds (professional, cultural, etc.), further impeding trust and the building of relationships. Communication breakdowns also skew perceptions of reality and the recognition and solving of problems. [Hartman and Ashrafi, 1996] E-communication furthermore affects the development of meaningful relationships because it allows parties to send a large volume of information. Indeed, communication is more efficient, but the drawback is that parties are alienated.

- **Organizational / Management**

E-communication influences the day-to-day operations of the virtual enterprise. For example, effective decision-making plays a key role in the success of a virtual enterprise. Not only must these decisions be made in conjunction with members of other organizations, the difficulty is heightened because typical decisions (design, marketing,

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manufacturing, distribution, etc.) are not sequentially related. [Strader, et al., 1998]
These decision processes are hard to manage in a traditional enterprise, much less in a
virtual environment.

Group dynamics are affected as well. One positive is that electronic communication
often helps groups with divergent thinking tasks. This is especially true if
communication is anonymous [DeSanctis and Monge, 1999] because people feel safer in
expressing ideas. In addition, high status members are not as likely to dominate group
meetings when compared to face-to-face groups. Conversely, face-to-face meetings often
enhance the ability to resolve conflict or reach a consensus. [DeSanctis and Monge,
1999] Geographic distances between member organizations pose other problems for the
virtual environment. Primarily, time zone barriers complicate coordination activities
because different times necessitate different work schedules.

Whether group or individual, communication is altered because of the virtual
environment. The nature of virtual enterprises often causes routine tasks to become
difficult. Wortman and Szirbik [2001] state that a simple disturbance (from a traditional
standpoint) can cause the contributing members to become bogged down while trying to
collect and interpret data in order to develop the proper situational awareness.

- **Technological**

Information/Internet Technology is a primary factor contributing to the rise in virtual
enterprises. IT connects member organizations and allows information to flow in a more
efficient and effective manner. It is needed to coordinate personnel, information systems,

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and processes among member organizations. The ever-increasing complexity of IT allows for these advantages. Certain issues arise, however, because of these increased complexities. Three primary areas of concern are: security, reliability, and compatibility.

1) Security – Networking organizations transmit large amounts of information across the Internet. Often this information is proprietary, and organizations share a concern as to the extent of its security in transmission.

2) Reliability – Reliability means that the same results are achieved on successive trials. The Internet and associated technologies are not completely reliable. It is common for servers to go down, computers to crash, and a number of other things to happen to result in reliability problems. In addition, it must be realized that the inter-connective nature of the Internet means that what affects one often affects others. For example, computer viruses spread and cause large amounts of damage to files and equipment before appropriate responses are developed.

3) Compatibility – Incompatibility issues arise as information is transferred across the Internet. Prior versions of software often cannot open documents produced by the latest version. A catch twenty-two exists in these situations because new features are important to production and increased capabilities. As new features are added continually, there is a tendency to always try to

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upgrade. Future partners may not update at the same pace, causing potential productivity-lowering compatibility issues.

9.1. Communication, Collaboration, and Access to Information

Communication must occur throughout the life cycle of the virtual enterprise. Specifically, three key areas are necessary: communication, collaboration, and access to information. The Internet allows for the attainment of each of these and is a key reason for the growth of virtual partnerships. The Internet alone, however, does not provide a complete tool to address the needs of each phase of the virtual enterprise life cycle. Another tool is needed to allow the three key areas to effectively interact in order to successfully accomplish the objectives of the virtual enterprise. That is, virtual enterprises need a central coordination tool. Project management can serve as this coordination tool.

Coordination, above all, is a major concern in virtual enterprises. Geographically distant members are harder to manage, and they provide control issues that must be addressed. The field of project management has made significant progress over the years. A major portion of the remainder of this chapter is used to discuss the concepts and characteristics of project management. In addition, a mapping of the relationships between virtual enterprises and projects/project management is provided to show that the coordination and control issues inherent to virtual enterprises logically relate to the benefits offered by project management. The Internet's role in communication,

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collaboration, and access to information is presented prior to the discussion on project management.

9.1.1. Communication

Communication is defined as "an art or instance of transmitting…a verbal or unwritten message…a process by which information is exchanged between individuals through a common system of symbols, signs, or behavior…exchange of information." [MWOD] This transmission of ideas can make or break a project, not to mention a company, due to the extreme importance and many media through which it travels. Tellez [1999] states that instant communication is critical in order to execute tasks on time and on budget. Therefore, it is imperative for everyone involved to not only be capable of communicating through common communication skills such as oral / body language, listening, and writing; but they should also be capable of using efficient and effective communication media. This is especially true of virtual enterprise brokers who must be a central source of information and communication for management and team members, as well as customers of the organizational entity.

Prior to the Internet, communication was almost entirely accomplished through the following means: 1) Oral – face-to-face interaction, phone calls, voice messages and 2) Documents – memos, letters, etc. However, technological innovations caused the following progressions: mail supplemented face-to-face communication, telephones and faxes supplemented mail, and computer-based technology is supplementing and/or

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replacing the traditional forms of business communication. Sommerhoff [1999] concurs: "the Internet and the technology that comes with it has facilitated our ability to acquire and disperse information, to communicate ideas…to others." The reasons for this progression are obvious. The Internet and computer based communications combine all of the traditional methods into one comprehensive package. Although conventional methods are fine means of communication, and each has its advantages, each also has disadvantages. One problem is that face-to-face communication cannot regularly occur for members from various locations. Phone calls are useful, but if no one is present to answer the call, a voice message must be left. In many cases this results in time wasted playing phone tag. In addition, the distant location between parties means additional time must be allowed for the transfer of documentation through the mail.

The advent of the Internet has led to many solutions to these problems. One example of the Internet's enhancement of business is that of face-to-face interaction. Today's technologies allow for video-conferencing to take place through the Internet thereby enabling face-to-face interaction even though parties are at different locations. The down side is that all parties must have common times to be available. The Internet also has allowed for more effective means of sending messages. Instead of picking up a phone and calling one or more people (which can be time consuming and potentially expensive), a person can type an e-mail message and send it to any number of individuals in a matter of seconds. From this message, the recipients have the capability of responding immediately by typing their response and replying to the sender's address. This

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synchronous means of communication can save significant amounts of time because less time is spent compared to repeatedly returning phone calls or playing phone tag until the parties are connected.

Additionally, the Internet has facilitated more efficient and effective flow of documentation. By simply attaching a document to an e-mail, whether text or graphics based, a recipient half way around the globe can receive a hard copy of the document in their hands in a matter of seconds. From this, they can review the document, communicate back on its content, or even highlight changes that must be made.

Other methods of communication are also available through the Internet and related Internet based technologies. For example, there are synchronous means such as chat rooms, Internet phones, and whiteboards that require everyone to be present at the same time. Examples of asynchronous media are message/bulletin boards, Internet fax, and other text-based tools.

9.1.2. Collaboration

One characteristic of virtual enterprises is their makeup of multiple human resources with different areas of expertise. To apply this expertise towards a single objective requires collaboration. It is impossible to define collaboration without communication. For this research, the process of collaboration is defined as communicating dynamically so that each piece of information builds upon the other such that progress toward project

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goals is accomplished. Thus, the combined total information is greater than the sum of the parts.

In a white paper by Collaborative Strategies™, collaboration is defined as: "The ability of two or more people or groups to transfer data and information with the capability of on-line interaction. The distinguishing feature is the ability for many-to-many interactions and information sharing, unlike e-mail where the interaction is one-to-one or one-to-many." [Collaborative Strategies]

A significant role of the virtual enterprise broker is assembling the right people in the right sequence to solve a multifaceted problem. The collaboration of these parties is critical since the members are, to a certain degree, interdependent. The entire project will suffer and other tasks become more difficult if a task, whose output is needed by another task, is not performed correctly. The virtual enterprise broker must oversee this task dependence and ensure that the risk of such problems is minimized through collaboration. Nicholas [1994], in discussing projects, concurs by saying that project teams rely on and accept one another's judgments. The elevated amount of sharing information and consulting that takes place in project work is high in collaboration.

From a project perspective, there are two levels of collaboration: project and task. At the project level, individual tasks are accomplished to produce a single project. All individual tasks, although performed separately, will need to experience collaboration. Task oriented collaboration involves people working together on a single task. The task in this sense generally is not divided into individual categories, but all individuals

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working on it are assisting each other to produce something that is beyond the capability of each individual.

The capabilities of the Internet further stimulate collaboration by allowing quicker, more frequent contacts with diverse team members. The amount of software designed to increase this contact and coordination has grown drastically during the last few years. Previously, software had to accomplish a specific task and then add Internet capability. Now because of the need to collaborate and the abilities the Internet offers, there is a great deal of focus on software that enforces and simplifies collaboration.

In addition, many advantages to collaboration can be achieved through the use of a common Internet-based database. A common database can be kept at a single site and people from various locations can connect to it. Team members modify information at a single location and eliminate the confusion of who possesses the latest information. The ability to attain data quickly, use the data, and return the results electronically enhances a team's ability to test or produce work.

The conferencing abilities of the Internet also enhance collaboration. Conferencing enables interactions of remote teams, which can review the status of projects, discuss with others who are actually doing the work and view products and samples. Data, charts, and other files are available and quickly accessed for reference. The virtual enterprise broker, instead of holding messenger status, can bring individuals together and manage the meeting.   Since travel is reduced, and time is saved for extended trips, electronic meetings become more cost effective.

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Collaboration succeeds only if all parties are basing their work on common information, and if they have the same direction. For fast paced projects, the information must be quickly updated with notification to the information users. The ability to maintain common information among remote personnel requires closely linked parties by means of a computer. Using electronic conferencing and on-line databases are ways to keep a diversely located group familiar with the process of events that may directly or indirectly affect their work.

9.1.3. Access to Information

Managers need to be able to obtain information about products, vendors, competitors, etc.; and managers also need to be able to distribute information to customers, employees, vendors, and various other people. In a virtual enterprise setting, individual member organizations must be updated about the status of costs, schedules, completed tasks, or other records. Many tools are available to help with this job.

Internet technology is one of the available tools to assist in these areas. The emergence of the Internet and other Internet related technologies allows for the availability of information to be at one's fingertips. Company web sites and e-mail have simplified the tasks of distributing reports, graphs, charts, or any type of records that need to be seen. These advancements make the Internet one of the better-known and most available resources for accessing information.

A related technology is the Intranet. The Intranet is essentially an Internet that is limited to use in a corporate environment. Brokers can use the Intranet to give secured access to important documentation that only team members need to see. The Intranet ensures that employees of a company can view any information about a product, client, or project at any time it is needed.

Team members may also use the Internet and Intranet for accessing real time or near real time information. Near real time is mentioned because of the delays, caused by electronic data processing, which occur in the process of distributing data. This quick access translates into saved time. Brokers use this to their advantage because quick access means an increase in the opportunities for proper management of the enterprise. Costs, schedules, and project performance are all items that need to be updated as soon as they are available to keep every one involved updated. Real time access is a major advantage of Internet and Intranet technologies and is a primary reason for the birth of the virtual enterprise concept.

9.2. Projects and Project Management

Projects have existed from the beginning of time. Whether a historical accomplishment such as that of the Egyptian pyramids, or tasks as described in the Bible, projects have always existed. Large or small, costly or inexpensive, projects abound in the world we live in. Accordingly, better ways of managing projects have resulted. This is especially true with the increased focus on project management in the recent past.

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9.2.1. What is a Project?

According to the <u>Project Management Body of Knowledge</u>, a project is "a temporary endeavor undertaken to create a unique product or service." [PMBOK, 2000, p. 4] PMBOK's definition provides for the identification of the key characteristics of projects. These characteristics include projects being temporary and having a unique product, service, or result. In addition to these traits, John Nicholas identifies that projects transcend organizational lines, involve unfamiliarity, and are basically a process to achieve a goal through work. [Nicholas, 1994, pp. 4, 24]

In describing projects as a process, PMBOK says that a project is composed of processes that fall into two major categories: a) project management processes and b) product oriented processes. Project management processes are those that control the overall completion of the project. Product oriented processes are those used to create the project's product. [PMBOK, 2000, 29-30]

9.2.2. Project Life Cycle

Much like a product goes through a life cycle, projects also have a life cycle defined by a certain sequence of key phases. Nicholas states that those phases include conception, definition, acquisition, and operation. The Conception phase includes both initiation (i.e., determining a need exists) and feasibility (i.e., investigating to determine if a solution is economically viable). The second phase, Definition, results in a detailed project plan and an identification of user and system requirements. Once all requirements

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are defined, the system can be properly defined in terms of subsystems, components of the subsystems, relationships, etc. The design of the system is part of the Acquisition phase. Also included are the development and production of the system, and transferring the system to the user. Finally, the Operation phase includes monitoring and improving the system and terminating it once objectives have been met or the system is no longer viable. [Nicholas, 1994, pp. 91-94]

Cleland and King [1988, pp. 482-483] describe the project life cycle in a similar manner. The first of four stages is that of Conceptualization. In this stage, a project is deemed necessary, preliminary goals and alternatives are specified, and potential means to accomplish the goals are identified. In the second stage, Planning, more formal plans are established such as scheduling, budgeting, etc. The actual work of the project occurs in the third stage, Execution. Finally, the Termination stage sees final activities such as release of resources and transferring the project to clients.

9.2.3. Project Management

Project management is "the application of knowledge, skills, tools, and techniques to project activities to meet project requirements." [PMBOK, 2000, p. 6] The 1996 version of PMBOK gives a slightly different definition: "the application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project." [PMBOK, 1996, p. 6] While projects have existed since the beginning of time, ways to manage projects have changed as the need for

greater dimensions of skills and technical complexity has evolved over time. [Nicholas, 1994, p. 7] Thus, project management is an important part of dealing with the ever-changing environment of today's projects.

Project management is a special type of management. [Nicholas, 1994, p. 21] In fact, of the knowledge needed to manage projects, much is unique to project management. [PMBOK, 2000, p. 9] This is most likely because traditional management often involves repetitive activities while a key aspect of project management is that each project is different from the previous one. Nicholas [1994, p. 25] expands by defining the following key characteristics:

- A project manager who is independent of the normal chain of command heads projects.

- The project manager is the nucleus for organizing all components' efforts to achieve the goal.

- The work is potentially performed by any number of functional areas.

- Members of various functional disciplines are integrated by the project manager and project team.

- The project manager with the functional managers performs negotiation in order to gain support. The project manager integrates the people and oversees the activities while the functional managers take responsibility for the personnel and individual tasks within the project.

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- There is a possibility of both vertical (functional) and horizontal (project) chains of command.

- The project team and functional units share in decisions, outcomes, accountability, and rewards.

- While the project itself is temporary, the functional units are permanent.

- The origin of projects may arise from anywhere in the organization.

- The result of project management is that other support functions, such as information systems and accounting, are set into motion.

9.2.4. Project Management Tools

Nicholas [1994, pp. 241 – 242] identifies major tools used for the purpose of managing projects. They include Work Breakdown Structures (WBS), Responsibility Matrix, Events and Milestones, Gantt Charts, Networks, Critical Path Analysis, PERT/CPM, cost estimating, budgeting, and forecasting. Additional concepts include risk assessment, the critical chain, and multiple project management.

9.2.4.1. *Work Breakdown Structures (WBS)*

A WBS is a method for logically dividing elements of the project into sub-elements, which are eventually broken into smaller pieces known as work packages. The purpose is that the smaller pieces allow for more ease in preparing cost estimates, project schedules, and assigning responsibilities for tasks and management. [Nicholas, 1994, pp. 242-249]

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9.2.4.2. Responsibility Matrix

A combination of the WBS and personnel within the organization results in a matrix showing personnel responsibilities for each work package of the project. It is also possible to determine responsibilities that individuals have to others in the organization while working on the project. [Nicholas, 1994, pp. 250-252]

9.2.4.3. Events and Milestones

If a project plan can be compared to a road map, an event is a point in time when something is usually started or finished (e.g., entering or leaving a county on the way to your destination). Events can be broken into interface events and milestone events. Interface events denote a change in responsibility or completion of one task and start of another. Milestone events denote more significant occurrences. [Nicholas, 1994, pp. 254-255]

9.2.4.4. Gantt Chart

A simple and commonly used planning tool, Gantt charts list all work elements on the vertical axis and provide a time scale on the horizontal axis. Bars are used to denote beginning and completion times of each element. From this chart, precedence relationships are seen, and an overall picture of the project is given in which the plan can be compared to actual progress. [Nicholas, 1994, pp. 255-260]

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9.2.4.5. Networks

One disadvantage of Gantt charts is that relationships between tasks are not shown. Another disadvantage is that the impact of delays or shifts in resources is also not seen. To solve this problem, networks are often used to connect project activities using arrows and nodes; this clearly shows both relationships (including time) and precedence. Two ways of constructing these networks are Activity on Node Diagrams and Activity on Arc Diagrams. [Nicholas, 1994, pp. 270-271]

9.2.4.6. Critical Path Analysis

In determining how long a project will take, there is a potential for many different paths to connect the start and the finish of the network. It is the longest path (i.e., in terms of time) that identifies the expected project duration. This path is known as the critical path. The activities along this path are known as critical activities, and focus must be given to these if the expected project completion time is to be reduced. These activities also represent those that, if delayed, will also delay the expected completion time of the project. Conversely, other paths within the network may be delayed for a given amount of time (known as slack time) because of the fact that their duration is less than that of the critical path. [Nicholas, 1994, pp. 282-291]

9.2.4.7. Program Evaluation and Review Technique and Critical Path Method

Two network methods are widely used for project planning, scheduling, and control: Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM).

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Both utilize the critical path for determining expected completion time as well as early, late, and slack times. PERT was developed based on projects where large amounts of uncertainty existed in terms of activities and their durations. PERT utilizes three time estimates to address this: optimistic, most likely, and pessimistic. These estimates are related through the Beta probability distribution, which is used to determine expected completion time and variance for each activity and the project. From this distribution, the probability of completing the project in a given amount of time can also be calculated. The difference in PERT and CPM is that for CPM only one estimate of time is used. In addition, CPM mathematically estimates the tradeoff between project cost and duration by analyzing how to best reallocate resources in order to reduce completion time for the least cost. [Nicholas, 1994, pp. 291-300, 313-320]

9.2.4.8. *Cost Estimating, Budgeting, and Forecasting*

Cost estimates often determine the outcome of a project. Estimating too high can lead to losing out to competition. Estimating too low can lead to winning the contract but losing money. While estimates and budgets are similar – sharing elements such as direct labor and direct non-labor expenses, overhead expenses, administrative expenses, profits, and total billing – there are differences. Estimates are developed first and, in turn, they are used to develop budgets. In addition to developing budgets, estimates for each work package may be used to forecast expenditures on a project for a given point in time. [Nicholas, 1994, pp. 340-371]

9.2.4.9. Risk Assessment

There are potential problems that could naturally occur during the time frame of the virtual enterprise. These potential problems, or risks, could impose a wide range of consequences if they were to occur. Thus, the events that could produce these consequences need to be identified. Once these potential risks are identified, they must be sifted through in order to eliminate those that are inconsequential, and the remaining ones must be ranked based on importance and need for consideration. These assessments are either subjective or qualitative. According to Clifford Gray and Erik W. Larson [2003], expert opinion/gut feelings are used most, but carry the potential for serious errors depending on the skill of those making the assessment. Alternatively, quantitative methods (examples include ratio analysis, probability analysis, and sensitivity analysis) tend to be more reliable but require more detail in the gathering of data and tend to be limited in scope.

9.2.4.10. Critical Chain

The Critical Chain, a concept created by Eliyahu Goldratt (1997), is a method for managing slack on a project network. It considers the fact that both resources and technical dependencies constrain the network. These ideas are then used as a means for accelerating project completion times. The concept is based on the idea that time estimates are developed so that there is a high chance they will be completed on or before the stated time (i.e., 80-90%). Given this, however, projects still routinely run over time.

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Goldratt believes this occurs because of the following reasons: excessive multitasking, resource bottlenecks, student syndrome (delaying start times until absolutely necessary), Parkinson's Law (work fills the available time), self protection (early finishes are often not reported in fear that more will be demanded in the future), and the dropped baton (early finishes do not always mean the next activity can begin due because people assigned the next task are not always ready to start early). Goldratt recommends that estimates be based on true 50-50 completion percentages in order to prevent project over runs. The safety that is removed because of the 50-50 estimates is then partially placed on the network as time buffers where problems are likely to occur (after all, a 50-50 estimate means about half will take longer than planned). These buffers include project time buffers (added to the expected project duration), feeder buffers (added where non-critical paths merge with the critical chain), and resource time buffers (inserted where scarce resources are needed for an activity). The buffers are then monitored closely and only used when dictated by management. [Gray and Larson, 2003]

9.2.4.11. *Multi-Project Management*

It is a high probability that organizations (virtual or not) are not focusing on a single project. In fact, there are almost always multiple projects being carried out in parallel. The difficulties that arise because of multiple projects are manifold. Examples include limited pools of resources, labor constraints, and scheduling conflicts. Because of the difficulties, the capability to manage one single project is not enough. Instead,

organizations must be able to coordinate and manage multiple projects. Bailetti, et al.
[1994] confirm this by saying that research has shown that effective coordination is an
important factor in differentiating successful from unsuccessful projects. They also say
that for large projects and those characterized by complexity and uncertainty (of which
multiple projects obviously fit), coordinating tasks typically will change as the project
moves through its life cycle. Due to these complexities and uncertainties that
characterize environments with multiple projects, there must be an alternate approach to
managing them successfully.

9.2.5. Project Management Processes

Characteristics of project management, such as those seen previously, can all be
considered as part of the project management processes that are used to describe,
organize, and finish the work of the project. [PMBOK, 2000, pp. 29-30] These project
management processes can be grouped into five subsets, each of which may contain one
or more processes of their own: initiation, planning, executing, controlling, and closing
processes. [PMBOK, 2000, p. 30]

- Initiation Processes – authorizing the project
- Planning Processes – defining and modifying objectives, choosing the best course
  of action to obtain objectives
- Executing Processes – coordinating people and resources to carry out the plan

- Controlling Processes – monitoring and measuring progress so any variance from the plan can be identified and corrected

- Closing Processes – formal accepting project, bringing project to an end

9.2.6. When is Project Management Needed?

Although project management originated in environments such as construction and aerospace [Nicholas, 1994, p. 30], the application of these techniques is now widespread. Two general conditions point to the need for project management: undertakings that are unfamiliar/unique and those that have numerous interdependent/interdisciplinary activities [Nicholas, 1994, p. 30]. Cleland and King also suggest five general criteria for deciding whether or not the techniques of project management are appropriate. They are:

- Magnitude of effort – Project management may be necessary when substantially more resources are required than are normally employed.

- Unfamiliarity – The tasks of a project are often unique when compared to normal tasks, thereby requiring special management techniques.

- Changing environment – Because of the need for creativity, innovation, and rapid response in rapidly changing environments, the flexibility of project management is often needed.

- Interrelatedness – Because different functional units are involved, a relationship needs to be built in order to ensure concurrent goals are being achieved and resources are properly managed.

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- Reputation of the organization – Failure to complete a project often results in numerous negative consequences to the organization. Project management techniques allow for better planning and control and often increase the odds of success. [Nicholas, 1994, pp. 30-31; and Cleland and King, 1983, p. 259]

9.3. Relating the Management of Virtual Enterprises to Project Management

The literature review suggests that a correlation can be made between a virtual enterprise and a project. Much has changed in the recent past in dealing with projects and how they should best be managed – namely the tools and techniques of project management. Given that a virtual enterprise can be related to a project, it is also likely that many of the methodologies used for project management may also be applied to the management of virtual enterprises.

The following tables are used to demonstrate that this relationship exists. Table 9.1 aligns the major characteristics of a project with those of a virtual enterprise. In similar fashion, Table 9.2 relates the life cycles of projects and virtual enterprises. Table 9.3 continues by aligning the characteristics of project management and virtual enterprises. Table 9.4 concludes the mapping process by demonstrating how the need for project management matches that of a virtual enterprise.

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Table 9.1: Relating the Characteristics of Projects and Virtual Enterprises

Project Characteristics [Nicholas, 1994]	Virtual Enterprise Characteristics
Temporary	"temporary alliance of enterprises" [Camarinha-Matos, et al., 2001] "temporary network organization consisting of independent enterprises" [Fuehrer and Ashkanasy, 1998]
Unique end product/service	virtual enterprises "aim to design, build, and sell specific products." [Furst and Schmidt, 2001]
Transcend organizational lines	different people contribute from the strategic apex to the operational level, and do not necessarily coincide in time or space" [Gil-Estallo, et al., 2000] "temporary organization of companies that … share costs and skills to address business opportunities that they could not undertake individually" [Choi and Bae, 2001]
Involve unfamiliarity	"temporary network that comes together to exploit fast-changing opportunities" [Byrne and Brandt, 1993] "virtual enterprises are … where different and independent partners exploit business opportunity by establishing an enterprise cooperation." [Lau and Wong, 2001]
Process to achieve a goal through work	"come together quickly to cooperate for a particular mission" [Arnold, et al., 1995 in Kanet and Faisst, 1999] "are short lived, extremely focused, goal-driven, and powered by time-based competition" [Levary, 2000]

Table 9.2: Aligning the Life Cycles of Projects and Virtual Enterprises

Project Life Cycle (Nicholas, 1994)	Virtual Enterprise Life Cycle (Strader, et al., 1998)
Conception- determine a need exists, determine if feasible	Identification- identify, evaluate, and select virtual opportunities
Definition- detailed project plan, identification of user and system requirements	Formation- partner identification, evaluation, selection; virtual enterprise formation
Acquisition- system design, development, and production; turning system over	Operation- interrelated processes such as design, marketing, financial
Operation Phase- monitor and improve the system, terminating the system	Termination- ceasing operations and disposal of assets

Table 9.3: Relating the Characteristics of Project Management and Virtual Enterprises

Project Management Characteristics [Nicholas, 1994]	Virtual Enterprise Characteristics
Headed by a project manager who is the primary organizer	Headed by a broker organization
Work is performed by any number of functional areas.	A virtual enterprise is made up of any number of member organization, each performing their core competency(ies).
Members of various functional disciplines are integrated by the project manager and project team.	Broker organizations act as the central coordinator in the network of participants.
The project manager integrates the people and oversees, while functional managers take responsibility for the personnel and individual project tasks.	While the broker coordinates the participants, each member performs their core competencies. Therefore, they are responsible for managing those tasks.
Possible for both vertical (functional) and horizontal (project) chains of command	Member organizations are responsible to the broker organization; however, each member maintains authority over those within their organization.
Project teams and functional units share in decisions, outcomes, accountability, and rewards.	Virtual enterprises cooperate by sharing abilities, knowledge, resources, decisions, and consequences (albeit liability or rewards).
Projects are temporary, but functional units are permanent.	The virtual enterprise is temporary, but member organizations maintain their existence.
Project origin may arise from anywhere in the organization.	Virtual enterprises arise to exploit fast-changing opportunities. Each opportunity is unique and can originate with any organization involved.
The result of project management is that other support functions such as information systems and accounting are set in motion.	As with most organizations---including virtual enterprises---support functions are necessary. Especially important are information technology systems that link each member organization.

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Table 9.4: Relating the Need for Project Management to that of a Virtual Enterprise

General Criteria for the Need of Project Management [Cleland and King, 1983, in Nicholas, 1994]	Virtual Enterprise Characteristics
Magnitude of Effort	"temporary organization of companies that … share costs and skills to address business opportunities that they could not undertake individually" [Choi and Bae, 2001]
Unfamiliarity	See Table 9.1
Changing Environment	"formed … to exploit fast-changing worldwide opportunities quickly" [Zhou, et al., 2000]
Interrelatedness	"a geographically distributed organization whose members are bound by a long-term common interest or goal, and who communicated and coordinated their work through information technology" [Ahuja and Carley, 1999]
Reputation of the Organization	Virtual enterprises help organizations maintain positive reputations by increasing their ability to effectively respond to the changing needs of a market.

Project management is typically thought of in terms of projects within a single, static organization. It is not hard to see, however, that there are relationships between projects and project management inside static organizations and projects and project management that cuts across organizational borders. Especially unique is the relationship that exists between a project and the tasks performed by a virtual enterprise. Given that this relationship exists, it seems very likely that the knowledge about project management and the methodologies associated with project management can also be applied to the management of virtual enterprises. Cascio [2000, p. 81] concurs and states that "at a macro level, a virtual organization consists of a grouping of businesses, consultants, and contractors that have joined in an alliance to exploit complementary skills in pursuing common strategic objectives. The objectives often focus on a specific project….the first managerial challenge of the virtual workplace: making the transition from managing time (activity-based) to managing projects (results-based)."

CHAPTER X

MOTIVATION

Motivation drives people to accomplish an objective. Different factors motivate
different people. Monetary incentives or other types of positive re-enforcement influence
some while others respond to consequences or negative reinforcement. In addition, there
is always the surveillance motivator – the thought that the boss is nearby. The
geographically distributed nature of virtual settings, however, precludes the use of total
surveillance mechanisms as a motivating factor. In fact, virtual enterprises cause
difficulties in implementing Tayloristic type controls [Handy, 1995; Wilson, 1999]. As
Parker [1998] (in Wilson [1999]) concluded, "the search is on for ways to energize and
capture the commitment of organizational members --- more cynically, to replace the
Tayloristic stick with the internalized carrot."

The ability to motivate, regardless of method, typically decreases when performed
across organizational borders (i.e., as in virtual settings). This is true from both an
employee and management perspective. Wilson [1999] states that it is important to have
assurance that the individual employees who often work beyond the gaze of formal
control mechanisms, will remain committed, continue improvement processes, and
develop new means for responding to customer needs. Likewise, firms will be forced to

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adapt compensation and performance evaluation systems to inspire managers to improve the performance of the overall network of organizations. [Strader, et al., 1998]

Motivation in the virtual environment determines the degree of success that will be achieved. While geographic distance affects the ability to motivate, other related considerations play a large role as well. The degree of communication and trust between parties influences an individual's motivation. Both are factors, however, that affect one another and are affected by the temporary and geographically distributed nature of the virtual enterprise. In addition, cultural values and beliefs (which also affect communication and trust) shape situations to which individuals are motivated. Finally, motivation itself is related to the needs of individuals. In the case of the virtual enterprise, each member organization places a certain importance on achieving specific needs. Therefore, partner selection plays a part in determining the motivations inherent to the virtual enterprise.

10.1. Achieving Motivation

Motivation is not solely an individual trait. Instead, it is the result of the interaction of an individual and his/her situation. For example, a person may be highly motivated to read the newspaper but lack the motivation to read an instruction manual. In an organizational context, Robbins [1998] defines motivation as "the willingness to exert high levels of effort toward organizational goals, conditioned by the effort's ability to satisfy some individual need." The continually changing cast in a virtual enterprise

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makes it harder to develop trust and commitment. [Weisenfeld, et al., 2001] Low levels of trust and commitment naturally affect motivation. Organizations often fear the loss of proprietary information or simply worry about the potential of contributing to the start of new competitors.

Achieving motivation in a virtual setting is a necessary, yet potentially difficult task. Each member should recognize that the relationship is mutually beneficial. Achieving common goals must play a part in the achievement of individual organizational goals. (Weisenfeld, et al., 2001; Varadarajan and Cunningham, 1995) The merits of the company (i.e., the virtual enterprise) for the public should also be clearly defined. The literature cites these concepts among others as ways to achieve motivation in a virtual setting. More specifically, the following factors are to be addressed: partner selection, internal marketing, reputation, trust, reward systems/incentives, and hands-on leadership. In addition to these factors, one should also consider the traditional theories of motivation. The traditional theories are briefly discussed in section 10.2. The remaining factors follow.

10.2. Traditional Theories of Motivation

Various theories of motivation appeared over the past few decades. These theories, while not universally applicable and often criticized, are indeed a foundation for motivational concepts. The traditional theories include Maslow's Hierarchy of Needs, Theory X and Theory Y, Motivation-Hygiene Theory, Cognitive Evaluation Theory,

Equity Theory, Expectancy Theory, Existence-Relatedness-Growth (ERG) Theory, Goal Setting Theory, McClelland's Theory of Needs, and Reinforcement Theory.

10.2.1. Maslow's Hierarchy of Needs

Developed by Abraham Maslow, this theory hypothesizes that everyone possesses a hierarchy of five needs: physiological (hunger, thirst, clothing, etc.), safety (from emotional and physical harm), social (acceptance, affection, friendship, etc.), esteem (internal factors such as self-respect, achievement, and external factors such as status and recognition), and self-actualization (self-fulfillment, achieving one's potential in life). These needs are ordered from low to high respectively. A new level becomes dominant as each lower level is achieved. [Maslow, 1954]

10.2.2. Motivation-Hygiene Theory

Developed by Frederick Herzberg, this theory states that the factors that result in job satisfaction are separate from those that result in dissatisfaction. Therefore, the elimination of factors that cause dissatisfaction will not necessarily cause motivation. These dissatisfaction factors are typically extrinsic (working conditions, policies, authority, relationships, etc.) and are characterized as hygiene factors. Motivation factors are typically intrinsic (responsibility, recognition, achievement, the job itself, etc.) and are necessary for increasing the desire of individuals to achieve outcomes. [Herzberg, et al., 1959]

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10.2.3. Theory X and Theory Y

Douglas McGregor believed that there are two views of human beings: negative (Theory X) and positive (Theory Y). Theory X says that employees dislike work, will avoid responsibilities, need to be controlled or coerced to achieve goals, and place more emphasis on security than other work-related factors. Theory Y says that people enjoy work, are self-motivated, often seek responsibility, and are capable of innovative decisions. [McGregor, 1960]

10.2.4. Cognitive Evaluation Theory

Cognitive Evaluation Theory states that the use of extrinsic rewards (e.g. pay) for work that is intrinsically rewarding will decrease the overall level of motivation. [de Charms, 1968]

10.2.5. Equity Theory

In Equity Theory, employees compare themselves to others based on inputs and outcomes. Whenever the ratio of one to the other is not equal, a feeling of inequity occurs and there is a motivation to correct the inequity. These motivations often emerge in terms of any of the following six actions: change inputs, change outcomes, distort perceptions of self, distort perceptions of others, choose a different referent, or leave the field. [Adams, 1963]

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10.2.6. Expectancy Theory

Developed by Victor Vroom, Expectancy Theory states that a person's motivation to act is determined by the degree to which they feel the action will result in an outcome that is attractive to them. That is, effort leads to performance, performance leads to reward, and rewards lead to the satisfaction of personal goals. [Vroom, 1964]

10.2.7. Existence-Relatedness-Growth (ERG) Theory

ERG Theory is a revision of Maslow's Hierarchy of Needs. Clayton Alderfer, who believes that people possess three groups of core needs (existence, relatedness, and growth), developed ERG Theory. Existence relates to Maslow's physiological and safety needs and is concerned with basic material needs. Relatedness is the desire to have important interpersonal relationships. It relates to Maslow's social needs and the external portion of esteem. Finally, growth needs are the desire for personal fulfillment. They relate to Maslow's intrinsic portion of esteem and self-actualization. [Alderfer, 1969]

10.2.8. Goal Setting Theory

Goal Setting Theory states that difficult and specific goals lead to higher levels of performance than do more generalized goals. [Locke, 1968]

10.2.9. McClelland's Theory of Needs

Developed by David McClelland and his associates, this theory focuses on three main needs that lead to motivation: achievement, power, and affiliation. Achievement is based on performing to a standard. Power is the ability to bring about behavior that otherwise would not occur. Affiliation is the desire for relationships. [McClelland, 1985]

10.2.10. Reinforcement Theory

Reinforcement theory argues that reinforcements control behavior. Reinforcers are consequences that follow an action. Favorable consequences condition the action to re-occur; unfavorable consequences condition the action to not occur again. [Skinner, 1953]

10.3. Motivation in Relation to Partner Selection

Human relationships provide key insights into motivation. Just as humans are motivated to work with certain individuals more so than others (based on skills, trust, abilities, etc.), a company's motivation is (to some extent) dependant on partner selection. For example, choosing a partner who previously demonstrated high levels of performance will lead to more initial motivation than choosing a partner whose performance levels are not known to be as high. Obviously, situations occur in virtual partnerships where picking the ideal partner is not possible. Therefore, utilizing appropriate partner selection criteria is vital to insure appropriate levels of trust and motivation in the early phases of the virtual enterprise.

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10.4. Internal Marketing

Marketing is traditionally associated with the promotion of products to consumers. Virtual enterprises take part in this external marketing concept by legitimizing the virtual company in the eyes of customers, suppliers, media, etc. They must also take part in internal marketing. Internal marketing is the promotion of the virtual enterprise in a way that the individual members are able to identify with the organization and see themselves as an integral part in accomplishing the overall objectives. Internal marketing concepts include joint development of goals, developing an Intranet, providing opportunities for face-to-face meeting, and properly communicating the corporate identity. [Weisenfeld, et al., 2001]

10.4.1. Belief Systems – Missions, Strategies, and Values

All businesses possess a mission. These missions are proclaimed in terms of mission statements, and they focus the employees on the objectives of the organization. Aside from the individual organizations, the partners of the virtual enterprise must jointly develop a mission. It is vital that all members participate in developing the mission because this development process helps to foster ownership. Ownership creates a personal stake / incentive to insure the accomplishment of the mission – i.e., it produces loyalty, commitment, and motivation.

Strategies are used to accomplish the mission of the enterprise. They outline objectives and methods for the enterprise to achieve those objectives. Members should

mutually develop strategies and the associated objectives to insure that each stakeholder is committed to their attainment. Strategies and objectives must be explicitly aligned with the needs of individual members. (Hartman and Ashrafi, 1996)

The establishment of a common value system is another way to energize commitment from the members of the virtual enterprise. Values represent basic convictions as to conducts that are acceptable or not acceptable. A value system is simply a ranking of values based on the intensity to which they are held. A virtual enterprise possesses an added challenge in developing mutual values because of the diversity of the members that make up the network of organizations (see chapter 7 – Culture). Despite these differences, a common set of values is necessary to instill confidence/trust and influence the motivation to cooperate with others.

10.4.2. Intranet

An Intranet is similar to the Internet and is based on the same type technologies. It possesses the capability to provide a common and specific channel of communication for the virtual enterprise. Intranets are designed so that outsiders (i.e., anyone not associated with the virtual enterprise) are not allowed access. In addition, Intranets provide more secure environments than the Internet, and firms can easily disconnect after terminating the partnership. [Strader, et al., 1998]

10.4.3. Face-to-Face Interactions

Workshops, meetings, and other social activities allow individuals to interact and develop a mutual bond that is not possible through technological communication. Trusting relationships can evolve from these interactions, and they contribute to the overall level of commitment and motivation.

10.4.4. Communication of the Corporate Identity

Each member organization should be able to identify itself with the virtual enterprise. There should be a common understanding of what the virtual enterprise is and the reasons for its existence. The development of a corporate identity cannot occur without proper communication throughout the network. Leadership must play a key role in disseminating the roles of the individual organizations and the role that each individual employee has in reaching the ultimate goal.

10.5. Reputation

The investigation of partner selection identified that reputation plays a key role in the evaluation of potential partners for a virtual enterprise. Reputation plays a similar role in the motivational process for members of virtual enterprises. Each organization is motivated by the effect performance has on reputation because organizations want to be seen by others as viable candidates for future partnering. High performance levels lead to good reputations and an increased possibility of partnering in the future with other organizations. Poor quality of performance, taking advantage of other partners, etc.,

results in the opposite – a bad reputation and decreased motivations for others to partner in the future. [Strader, et al., 1998]

10.6. Motivation in Relation to Trust

Virtual enterprises are comprised of geographically distributed and independent organizations. These members are often diverse, contain uncommon backgrounds, and possess few similarities – all of which diminish the willingness for each to work with the other. Mutual trust must be developed to overcome these differences and provide incentives to cooperate more effectively. [Mayer, et al., 1995]

For further information on the issue of trust in virtual enterprises, refer to chapter 8 – Trust.

10.7. Reward Systems/Incentives

Strader et al. [1998] say that organizations will have to provide incentives for managers to cooperate with other organizations to improve performance of the virtual enterprise. They feel that adapted performance evaluation and compensation systems are ways to provide these incentives. Suchan and Hayzack [2001] state that reward systems must create healthy competition. They should not undermine trust in fellow partners, team cooperation, and the desire to share information. Both team and individual accomplishments should be rewarded (see the definition of motivation). The rewards

must be aligned with strategy. This will increase the likelihood of effective communication. For example, Suchan and Hayzack [2001] discuss an unnamed company that tied bonuses to team performance. This provided a key incentive to help struggling team members with their job and encouraged information sharing about best practices and/or lessons learned from similar situations.

10.8. Hands-on Leadership

Leaders motivate others to behave in a certain fashion. Those who lead from a distance often lose touch with, and diminish the importance of, the human dimension. Correspondingly, motivation to follow a certain path is also diminished. Alternatively, leaders who personally address individual needs develop a bond between the team member and the organization. [Suchan and Hayzak, 2001] This bond leads to deeper levels of trust, higher levels of communication, and more motivation to achieve a desired end result.

Leaders play a key role in fostering communication among team members. Communication affects trust and commitment levels, which affect performance. Robbins [1998] conveys three key qualities of effective leaders.   First, leaders possess the ability to clearly explain (orally and through writing) their vision to others. Second, they express the vision through behavior. That is, their actions convey and reinforce the vision. The third quality is the ability to convey the importance of the vision for each area of the business. Marketing, research and development, etc., must all see why the vision is meaningful.

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CHAPTER XI

SYSTEMATIC APPROACH TO DEVELOPING

VIRTUAL ENTERPRISES

The growing movement to use virtual structures results from the desires to meet customer demands in a quick and efficient manner. The temporary nature and uniqueness of each virtual enterprise, coupled with the relative newness of this structure, requires organizations to incorporate new and/or unproven operational and managerial techniques. The literature highlights five management activities – select partners, develop communication, develop culture, develop trust, and enhance behavior through motivation – where key problems arise. More specifically, the management problems are primarily interface management problems – that is, problems that arise between the members of the virtual enterprise.

While virtual enterprises may experience problems in only one of the five activities, it is logical that interactive relationships exist among all of the activities. Based on the literature, Figure 11.1 illustrates the possible interactions of the interface management problems of virtual enterprises. That is, the literature provides examples that, as a whole, give evidence to the fact that the activities relate to one another. Table 4.2 shows example relationships between all of the activities. The possible web of relationships

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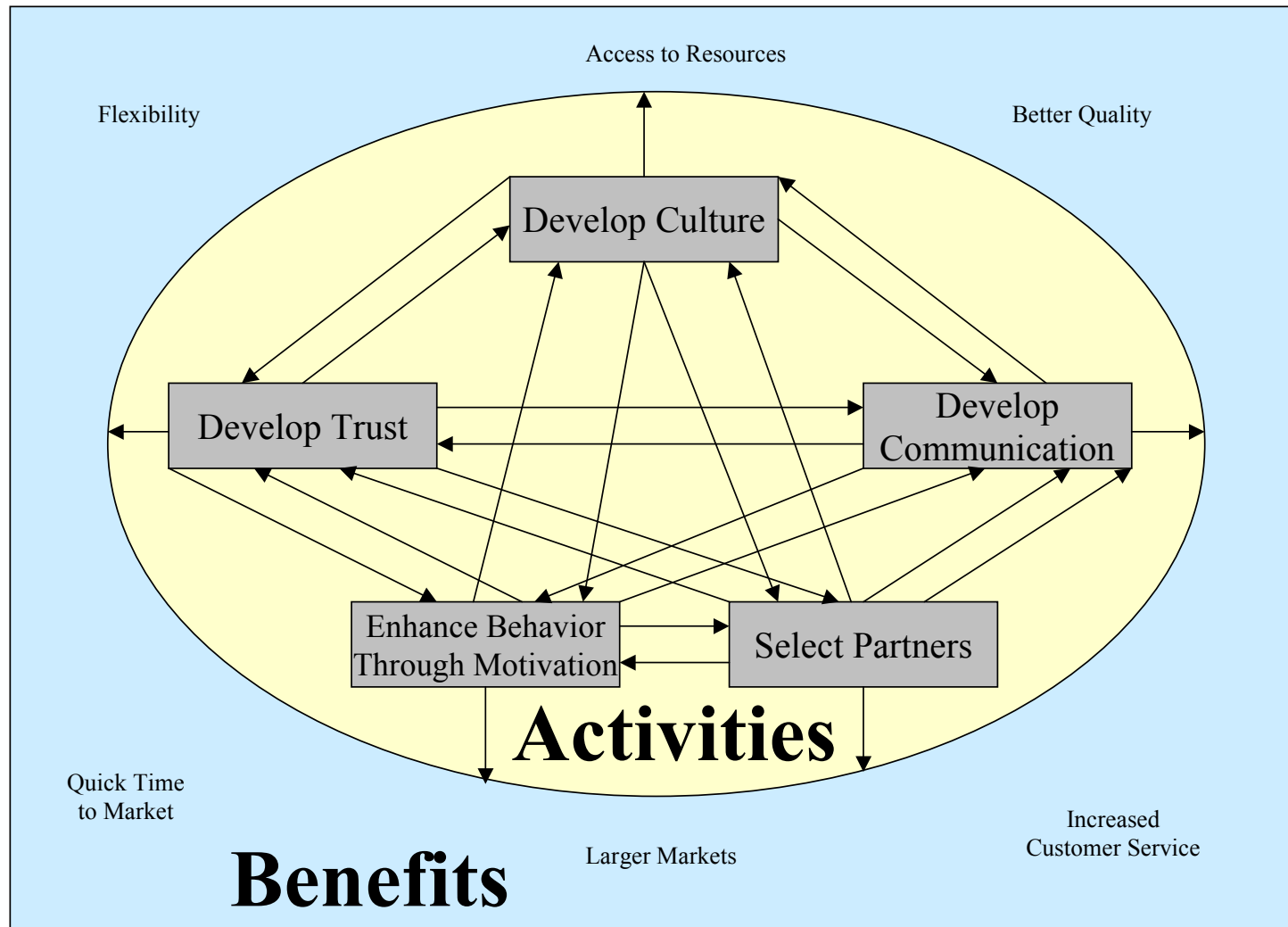
Figure 11.1: Possible Interaction of the Activities and Their Influence on Potential Benefits

poses a complex problem: determining the overall impact of specific improvements. A purpose of this research is to identify and define the important relationships between the five activities. Understanding the key relationships reduces this complexity. Therefore, this research provides brokers with an instrument to more effectively develop a virtual enterprise and thereby proactively address the interface management problems.

In order to illustrate and integrate the disjointed findings from the literature that were presented in Chapters 6 – 10, two standard diagramming tools, IDEF0 [Marca and McGowan, 1993] and influence diagrams [Miller, et al., 1976; Howard and Matheson, 1984], are utilized. These tools were chosen because of what they were designed to model. IDEF0 models activities that must be utilized to accomplish an objective, and Influence Diagrams model decision problems. Brokers must understand the decisions they are faced with as well as the necessary activities in order to proactively address the key problems that arise. Therefore, both techniques are utilized. Prior to observing these diagrams, note that Figure 11.2 provides a representation of the primary relationships between the interface management areas and their influence on the potential advantages. After a brief introduction to IDEF0 and influence diagrams, this chapter will substantiate the relationships illustrated in Figure 11.2. Note that the relationships are numbered. The numbers are utilized as references in the subsequent sections to reveal how each relationship is developed.
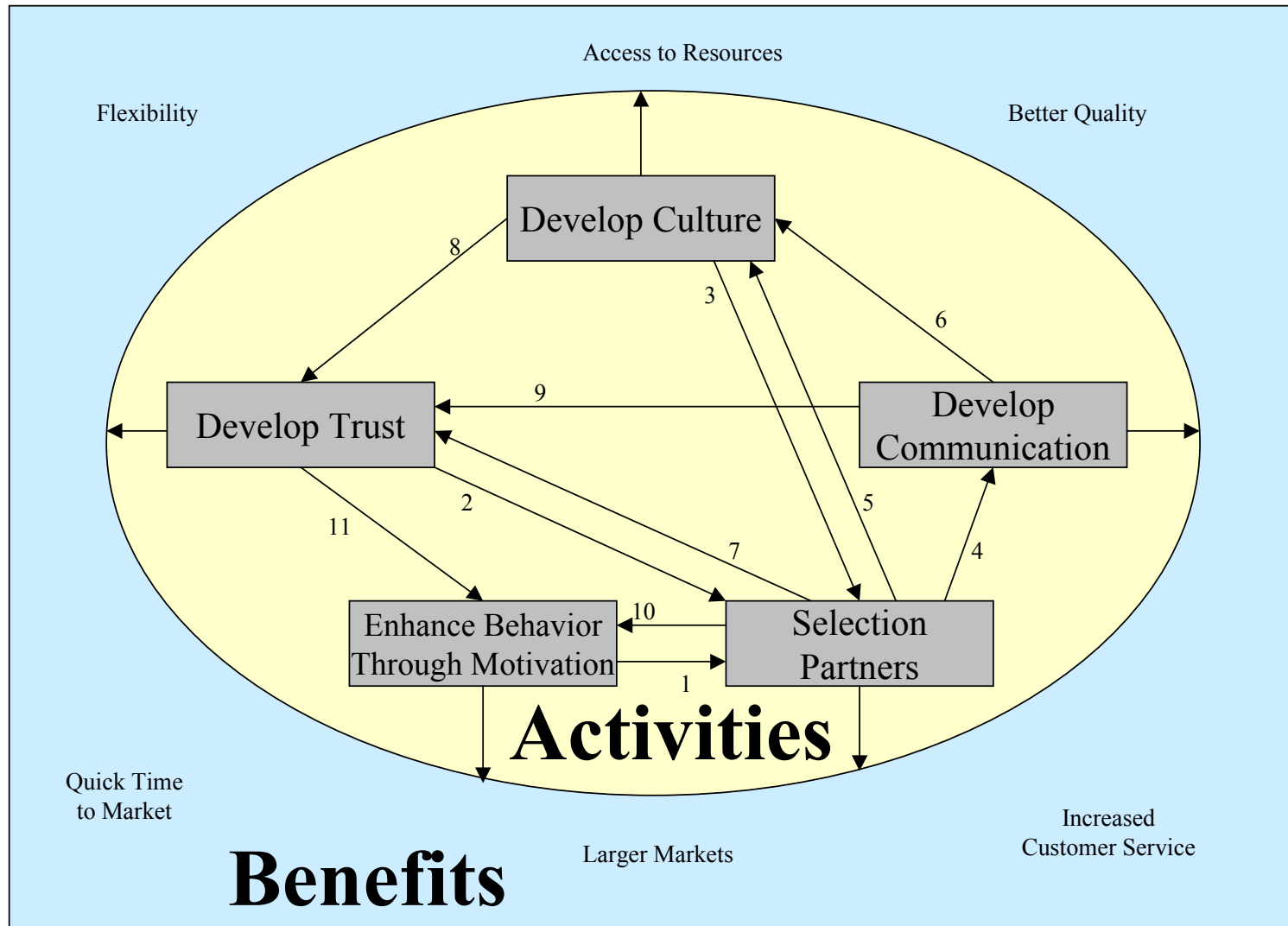
Figure 11.2: Representation of the Primary Relationships Between the Five Activities

Access to Resources

Flexibility

Better Quality

Develop Culture

8

3

6

Develop Trust

9

Develop Communication

11

2

5

7

4

Enhance Behavior Through Motivation

10

Selection Partners

1

Activities

Quick Time to Market

Larger Markets

Increased Customer Service

Benefits

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11.1. IDEF0

IDEF0 is a widely used diagramming technique that is based on the Structured

Analysis and Design Technique (SADT) developed by Douglas T. Ross in the early

1970's. [Marca and McGowan, 1993] IDEF0 uses layers of diagrams to show increasing

detail. The first level of detail is known as a summary diagram. This diagram

summarizes the overall objective to be accomplished. The second level of detail, the top-

level diagram, identifies the key activities that must occur in order to accomplish the

overall objective. The third level of the diagram illustrates the tasks that are to be

accomplished within each activity identified in the top-level diagram. Further layers are

based on the same rationale. The number of layers utilized varies with each situation,

depending on the detail necessary to adequately describe the circumstances.

11.1.1. Generic Representations of IDEF0

Figure 11.3 represents the basic structures used in an IDEF0 diagram. IDEF0

diagrams consist of boxes and arrows. The boxes represent activities or functions and are

titled with verb-noun phrases. The arrows represent the transformation of data, objects,

information, etc. and are labeled with nouns or noun phrases. There are four basic types

of arrows: input, output, control, and mechanism.

- Input Arrows- enter the left side of a box and represent the objects that are
  transformed.

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- Output Arrows- exit the right side of a box and represent the things that are produced by the function.

- Control Arrows- enter the top of a box and represent guides to the transformation.

- Mechanism Arrows- enter the bottom of a box and represent the ways and means an object is transformed.

Controls

Inputs

Activities
(Functions)

Outputs

Mechanisms
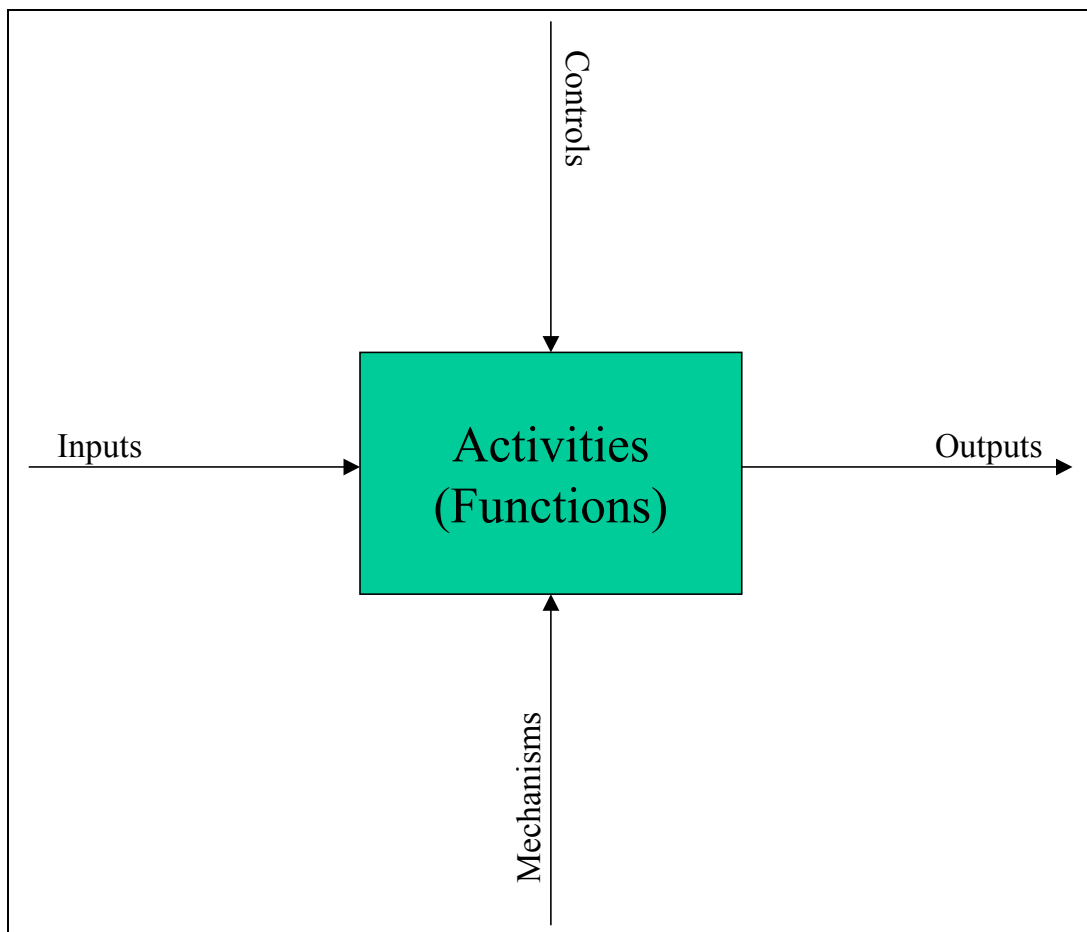
Figure 11.3: Basic Structures Used in IDEF0 Diagrams

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In order to help the user more fully understand the meaning behind each arrow, a dictionary is often used to compliment IDEF0 diagrams. For the subsequent diagrams, a dictionary is provided in Appendix F. In the following sections that describe the IDEF0 diagrams, terms found in the dictionary are *italicized*.

For more detailed information on IDEF0 diagramming, see Marca and McGowan [1993].

11.2. Influence Diagrams

Influence diagrams are graphical representations of decision problems. Miller, et al. [1976] and Howard and Matheson [1984] originally developed influence diagrams as a computer-aided modeling tool. [Kim, 1997] An influence diagram is a network consisting of nodes and arcs. There are three types of nodes – decision, chance, and value – which are represented as squares, circles, and rounded squares, respectively. There are two types of arcs: conditional (those leading to chance and value nodes) and informational (those leading to decision nodes).

Decision nodes represent the choices available to the decision maker. Chance nodes represent random variables or uncertain quantities that cannot be directly controlled. The value node represents the objective to be maximized (or minimized). Conditional arcs denote probabilistic dependence but not time dependence. Information arcs imply information available at the time of a decision. Two nodes without arcs between them

indicate independence. If a chance node contains no directed arc into it, the probability

distribution is unconditional. [Shachter, 1986] Figure 11.4 represents the basic

structures used in an influence diagram.
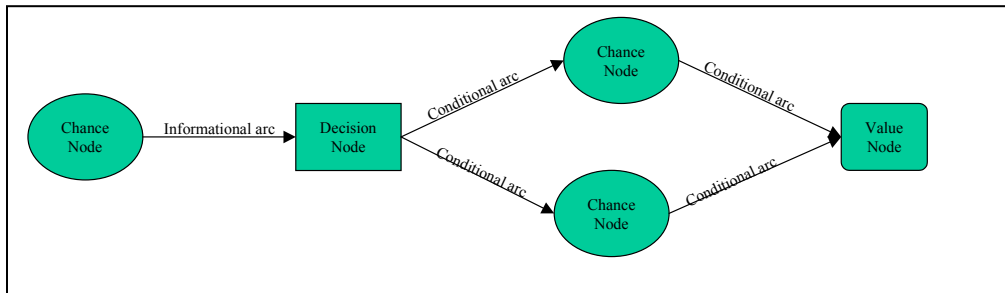
Figure 11.4: Basic Structures Used in Influence Diagrams

The initial influence diagram concept identified three levels to the decision problem:

relation, function, and number. The relation level indicates that variables generally

depend on other variables (e.g., taxes are based on taxable income and the tax rate). The

functional level identifies the exact function of the relationship (e.g., taxes = taxable

income * tax rate). The number level incorporates the actual numbers to calculate the

function. [Howard and Matheson, 1981; Smith, et al., 1993]

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11.3. IDEF0 and Influence Diagrams: Differences and How They Relate to Modeling the Key Virtual Enterprise Problems

One of the primary differences between IDEF0 and influence diagrams is the types of arcs utilized. While the arcs in influence diagrams represent influences (including information), they do not necessarily imply causal relationships or flows of data, objects, etc. The arcs utilized for IDEF0 do represent the transformation of data, objects, information, etc. In addition, the placement of these arcs clearly indicates whether the object represents an input, output, mechanism, or control. This provides the user with a better visual representation of these concepts and a more precise specification. While influence diagrams do not represent these features in as clear a manner as IDEF0, they do provide better visual displays of decisions that are to be made as well as chance events that may or may not be dependent on other actions. This is important, especially in terms of the virtual enterprise broker. Although the broker does not directly control the chance events, the broker must understand external factors and decisions that affect the chance events. Understanding these relationships leads to effective means for addressing the primary problems associated with virtual enterprises.

Another key difference between the two diagramming techniques is based on the types of situations they were designed to address. Influence diagrams were designed to represent decision problems and are highly related to decision trees. Decision trees

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naturally represent asymmetric[1] decision problems. This, however, is one of their main weaknesses; they grow exponentially in variables with the representation of each scenario. [Nielson and Jensen, 2003] Smith, et al. [1993] state that the power of an influence diagram lies in its ability to concisely and precisely describe the structure of a decision problem. Kim [1997] agrees and states that influence diagrams focus attention on the most relevant factors. Omitting information reduces the number of variables to interpret and saves time and effort. These savings relate to decision problems of the symmetric nature, but savings significantly decrease as problems increase in asymmetry. [Smith, et al., 1993]

While influence diagrams are ideally used for decision problems, IDEF0 is a diagramming technique used for identifying activities that must occur in order to accomplish some overall objective. The brokers of virtual enterprises obviously must make a number of critical decisions in order to address the primary interface management problems. This research, however, has also shown that a key factor in properly addressing the interface management problems is that brokers must organize certain activities in a manner so that the interaction of the activities leads to certain identified objectives: ideal partner selection, effective communication, a more compatible culture, and increased levels of trust and motivation. Therefore, both methodologies are utilized to more fully capture the concepts discussed earlier in Chapters 6 – 10.

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[1] Decision problems are asymmetric in that the possible outcomes of chance variables vary based on conditions. [Nielson and Jensen, 2003]

11.4. The Use of IDEF0 and Influence Diagrams to Model Interface Management in Virtual Enterprises

The IDEF0 diagrams in this chapter use three layers of detail in order to appropriately model the activities and tasks necessary to properly address interface management. Influence diagrams are used to complement the IDEF0 Diagrams. Influence diagrams are referenced within IDEF0 diagrams to more effectively model decisions. The remainder of this chapter discusses these diagrams as they apply to interface management in virtual enterprises. The diagrams represent the key relationships that are illustrated in Figure 11.2. It is important to note that IDEF0 and influence diagrams are not intended to replace other forms of communication – they are intended to complement them. [Marca and McGowan, 1993] For the diagrams in this chapter, the basis behind each is described in detail in the preceding chapters (i.e., chapters 6, 7, 8, 9, and 10). These chapters relate to the five key interface management activities. Please refer to these chapters, as needed, in order to fully understand the rationale behind each diagram's representations.

11.5. Summary Diagram

Figure 11.5, entitled "Develop Virtual Enterprises," represents the primary objective and activity performed by virtual enterprise brokers: properly develop virtual enterprises in order to proactively address problems arising due to disparate members of the virtual enterprise. This activity is initiated by the decision to partner. Partnering allows each member organization in the virtual enterprise to focus on specific tasks that they hold as core competencies. In Figure 11.5, the *potential partners* and *virtual enterprise tasks* are

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represented as inputs. In performing the specific tasks, the broker and partners must deal with interface management, properly respond to problems, and produce a desired *task behavior* (partners that work together as a team and efficiently and effectively meet their objectives). This desired behavior is represented as an output in Figure 11.5.
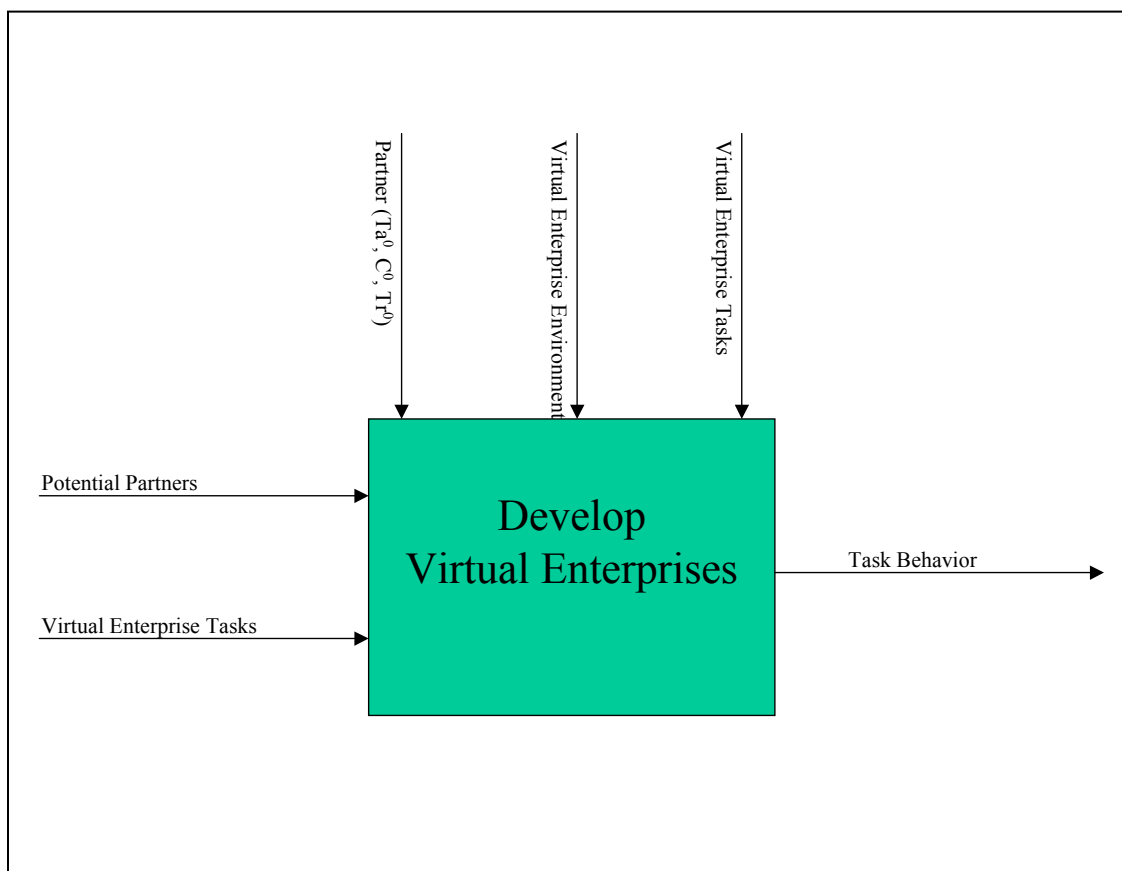
Figure 11.5: Summary Diagram – Develop Virtual Enterprises

The methodologies used to manage interfaces are often dependent upon the existence of certain controls. In virtual enterprises, controls include such things as the environment

in which the virtual enterprise operates; the defined tasks of the virtual enterprise; and a partner attribute denoting how well the partners rate in terms of their ability to perform necessary tasks, their tendency to have a compatible culture, and trust. Each of these controls is discussed in more detail in subsequent sections.

11.6. Top Level Diagram

Figure 11.6 represents the major activities involved in the development of virtual enterprises. It also represents the primary relationships between the activities. These activities and their relationships were built from the ground up and are based on an in-depth analysis of individual activities that were identified in the literature. Each of the activities represented in the top-level diagram is briefly discussed next. The individual activities are discussed in more detail in the subsequent sections where third level IDEF0 and influence diagrams are presented. Figure 11.6, however, is presented initially to provide one with a high-level understanding and orientation of the key activities and their relationships.

11.6.1. Select Partners

A broker's partner selection decision begins with a group of *potential partners*. A primary control in the selection process is the tasks to be performed by the virtual enterprise. In fact, the *virtual enterprise tasks* are controls for all of the activities represented in the top-level IDEF0 diagram. The tasks of the virtual enterprise also serve

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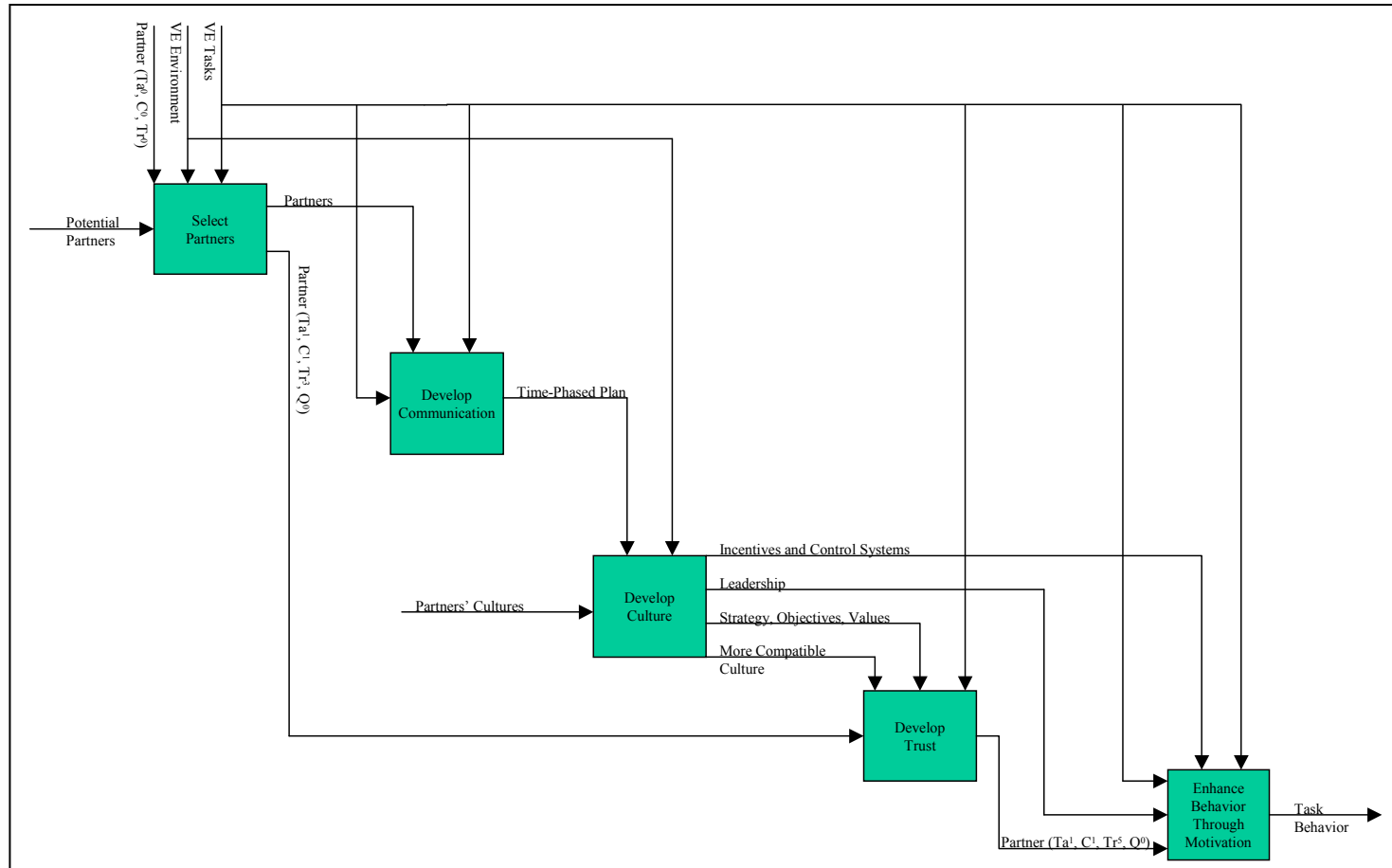
Figure 11.6: Top Level Diagram – Manage Virtual Enterprise Problems

as inputs to the activities entitled "develop communication" and "enhance behavior through motivation". These primary relationships highlight the necessity for brokers to properly define the tasks of the virtual enterprise. Adequately defined tasks result from a detailed planning and evaluation process by the broker. Section 5.5 discusses the major activities necessary for the creation of a virtual enterprise. More specifically, Section 5.5.1 discusses the need for a broker to complete a feasibility study as part of the virtual enterprise creation process. The feasibility study, as illustrated in Figure 5.1, includes the development of a Request for Proposal (RFP), discussed in Section 5.5.1.2. The RFP document solicits work from the potential partners. The RFP identifies the objectives, the project scope (i.e., the necessary activities, their sequence, and duration estimates), the necessary resources, the performance specifications, and cost and schedule constraints. The broker, by properly identifying these needs, develops a strong set of requirements on which to evaluate each partner's ability to perform the tasks of the virtual enterprise. Therefore, it is vital that the broker develop a Work Breakdown Structure (WBS) that properly identifies the necessities (mentioned above and found in Figure 5.1) of the virtual enterprise. This is a major step in the virtual enterprise development process.

The other controls to the selection process include the *virtual enterprise environment* and a characterization system, initially denoted as *Partner (Ta^0, C^0, Tr^0)* where Ta^0, C^0, and Tr^0 indicate how well a potential partner is graded in terms of task capability, cultural

compatibility, and trust, respectively. These controls are discussed further as a more detailed IDEF0 diagram for partner selection is presented.

A major output of the "select partner" activity (besides chosen *partners*) is a refinement in terms of how each partner measures in regard to task capability, cultural compatibility, and trust. In addition, a new score is added based on a *quantitative comparison methodology*. The process for refining these scores is discussed later.

11.6.2. Develop Communication

Once partnership occurs, there is a great need to develop the communications between member organizations in order to ideally transform the *virtual enterprise tasks* into a *time phased plan* (i.e., appropriately supplied information and properly coordinated activities). The types of information and communication technologies that are available often dictate the degree to which members communicate. In addition to communication channels, project management is needed to aid virtual enterprises in properly coordinating the activities necessary to achieve their objectives. These concepts are discussed further as more detailed IDEFO diagrams are presented.

11.6.3. Develop Culture

Culture is often described as a mutual set of values. In addition to values, mutual goals and management approaches/procedures are commonalities to those within a specific organizational culture. An objective of a virtual enterprise broker is to transform the *partners' cultures* into a *more compatible culture*. *Leadership*; *incentives and control*

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systems; and the definition of a *strategy, objectives, and values* are also primary outputs of the cultural development process. They become either controls or inputs to the remaining activities in the top-level diagram. The controls (discussed in more detail later) to the cultural development process include the previously developed *time-phased plan* and the *virtual enterprise environment*.

11.6.4. Establish Trust

Since trust changes over time, some initial level of trust leads to a partner decision. This level of trust is denoted as "Tr^3" in the previously discussed output, *Partner (Ta^1, C^1, Tr^3, Q^0)*, of the "select partner" activity. It is important for the broker, in conjunction with the partner organizations, to build upon this trust through trust development activities/concepts. The *virtual enterprise tasks*; a defined *strategy, objectives, and values*; and a *more compatible culture* all serve as major controls to trust development. The output, *Partner (Ta^1, C^1, Tr^5, Q^0)*, represents the trust that results from applying the mechanisms in this step.

11.6.5. Enhance Behavior Through Motivation

Motivation is dependent on an individual's personality and the environment in which he or she is placed. While motivation is often difficult in an organization, a virtual enterprise only adds to the difficulties. Inputs to motivation include the *virtual enterprise tasks*, *leadership*, and trust level (denoted as "Tr^5" in the input, *Partner (Ta^1, C^1, Tr^5, Q^0)*). Motivation takes these inputs and utilizes mechanisms in a manner that results in a

desired *task behavior*. *Incentives and control systems* and the *virtual enterprise tasks* serve as controls to the motivation process. Motivational tactics, both general and virtual enterprise related, produce behaviors that affect the virtual enterprise in two key ways. First, they shape the existing virtual enterprise's on-going trust development processes. The impact on the existing virtual enterprise creates a cycle that continues until the virtual enterprise is terminated. Second, they influence the possibility of additional partnerships. Organizations that exhibit low levels of motivation create trust issues that become barriers between them and the broker. These barriers serve as a future guide to partner selection decisions (see relationships #1 and #2 in Figure 11.2).

11.7. Third Layer Diagrams

11.7.1. Select Partners

A successful start to a virtual enterprise depends on proper partner selection. While virtual enterprises are beneficial because of their quick conglomeration, the effort needed to adequately select partners should not be sacrificed. The activities in this partner selection methodology are a collection of the ideas found in the literature of three areas: virtual enterprises, mergers, and supplier performance measurement. Figure 11.7 represents the necessary activities using the IDEF0 methodology. The selection process consists of a series of evaluations. The first two are qualitative analyses and are used to refine the *potential partners* into a set that will be quantitatively compared.

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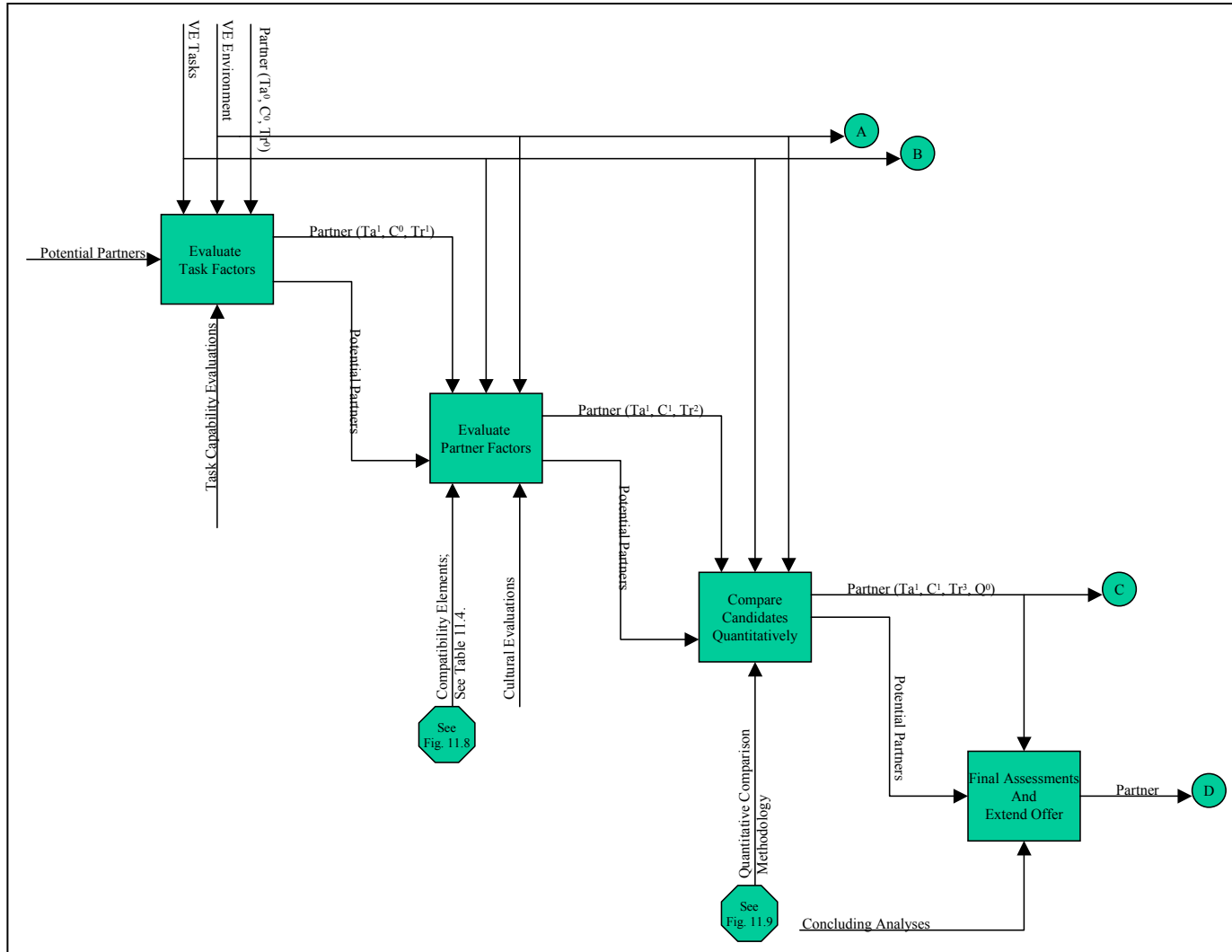
Figure 11.7: Third Layer Diagram – Select Partners

11.7.1.1. Evaluate Task Factors

Task factors are characteristics that relate to the specific tasks that member organizations are expected to perform. Examples of task factors include: operational skills and resources, knowledge of the local market and culture, knowledge of the product environment, access to distribution channels, and political influence. [Arino, et al., 1997; Glaister and Buckley, 1997] In order to properly evaluate a potential partner's ability to perform a specific task, the *virtual enterprise tasks* must be adequately defined. This is represented in Figure 11.7 as a control. The importance of properly identifying the tasks of the virtual enterprise is discussed in Section 11.6.1. Another control is the *virtual enterprise environment*. In addition to being able to perform the necessary tasks, it is often beneficial for a potential partner to understand the conditions (whether political, social, or cultural) that influence the virtual enterprise's existence. Note that the two controls just described are extended to the right and marked with the letters *A* and *B* (and the letters are encircled). This is indicative that the controls will be utilized in another IDEF0 diagram (not necessarily as the same type of arrow). Similar representations are used throughout the IDEF0 diagrams to denote inputs, outputs, controls, and mechanisms that will be utilized in another IDEF0 diagram or originated in a previous IDEF0 diagram.

The final control, *Partner (Ta^0, C^0, Tr^0)*, indicates how well a potential partner can perform the task, fits within the existing culture, and is trusted. These measures are null (---) if the broker has no prior knowledge of the potential partner. Prior relationships

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with, or knowledge of, the potential partner may result in a preliminary measure. While dependent on the broker, an example range of scores is provided in Table 11.1.

The initial scores are refined with each step in the partner selection process. Through the use of *task capability evaluations*, an output of this step is represented as *Partner* (Ta^1, C^0, Tr^1). Ta^1 represents an updated assessment of task capability because of the broker's better understanding of the potential partner's ability to perform the task. Tr^1 represents an updated assessment of the level of trust the broker has for the potential partner. The knowledge gained and relationship developed with the potential partner

Table 11.1: Example Scores for Task and Culture Evaluations and Trust

Task Scores	
Yes	Can perform necessary tasks
No	Cannot perform necessary tasks
---	No knowledge to date

Culture and Trust Scores	
5	Excellent
4	Good
3	Adequate
2	Less than Adequate
1	Poor
---	No knowledge to date

(due to the *task capability evaluation* process) causes this score to change. As an example, Table 11.2 provides an assessment of four potential partners prior to a task capability evaluation. Table 11.3 provides the assessment after a task capability evaluation.

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Table 11.2: Example Scores Prior to Task Evaluations

Potential Partner	Task Evaluations	Cultural Evaluations	Trust
A	Yes	---	---
B	---	---	---
C	Yes	4	3
D	---	---	---

Table 11.3: Example Scores After Task Evaluations

Potential Partner	Task Evaluations	Cultural Evaluations	Trust
A	Yes	---	2
B	No	---	1
C	Yes	4	4
D	Yes	---	3

11.7.1.2. *Evaluate Partner Factors*

Partner factors are general characteristics of an organization that may determine the
degree to which a positive and successful relationship will occur. [Arino, et al., 1997;
Glaister and Buckley, 1997] This step relates to the need for a pre-cultural assessment of
partners, as described in the literature on mergers. The degree of success depends highly
on the compatibility between organizations. Therefore, it is important to perform a
cultural assessment prior to partnership decisions (see relationship #3 in Figure 11.2).
These *cultural evaluations* further impact the potential partner's scores in terms of culture

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$(C^0 \rightarrow C^1)$ and trust $(Tr^1 \rightarrow Tr^2)$. These changes are denoted with the output labeled

Partner (Ta^1, C^1, Tr^2). As referenced in Figure 11.7, Table 11.4 (based on Miller, 2000;

Horwitz, et al., 2002; Mirvis, 1985; and Schraeder and Self, 2003) provides example

issues to consider during a pre-partner cultural assessment. Section 7.6 discusses this

important step.

Table 11.4: Example Issues to Consider During a Pre-Partner Cultural Assessment

Budget and Projections
Compatibility of Business Systems (technological infrastructure)
Conventions for Long Range Planning
- Corporate Values
- Engineering and Research and Development Infrastructure
- Management Approach (including decision making and flexibility)
- Management Reports and Reporting Procedures
- Management Strengths and Weaknesses
- Manufacturing and Procurement Processes
- Mutual Goals Desired Through Integration
- Needs/Opportunities for Organizational Restructuring and Design
- Organizational and Human Resource Structures
- Support of Integration

In addition to considering the compatibility of cultural elements, Olie [1994] suggests

performance is based upon three other factors: the type of merger combination, the

degree to which parties value and want to retain their organizational integrity, and

whether the organizations' relationships are symmetrical or asymmetrical. The combined

influence of these concepts on compatibility is illustrated in Figure 11.8. Figure 11.8 acts

as a mechanism to the "evaluate partner factors" activity. Note that this mechanism (in Figure 11.7) has an octagon (with a reference to Figure 11.8) attached to the beginning of the arrow. For the IDEF0 diagrams presented in this chapter, any reference to an influence diagrams will be identified with the same octagon symbol.
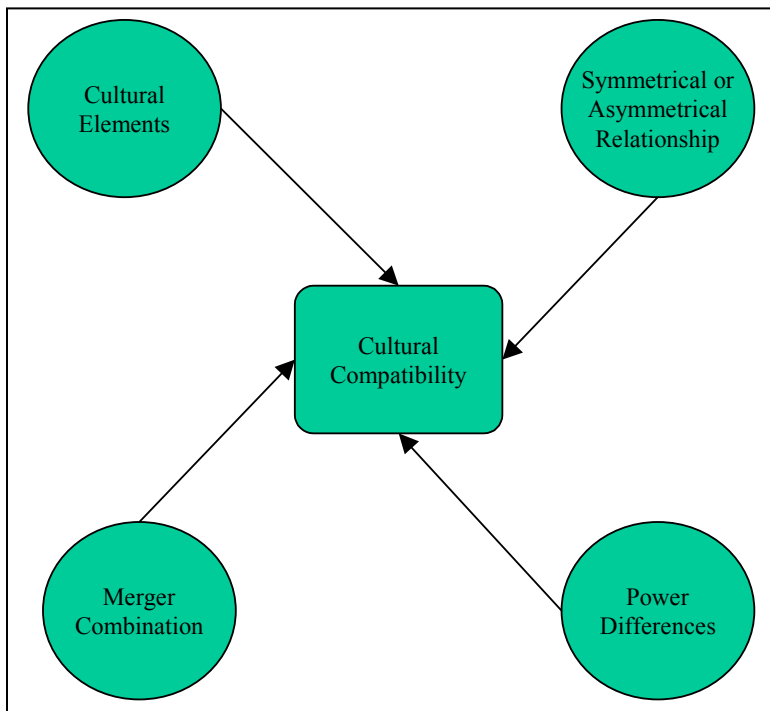
Figure 11.8: Elements that Affect Cultural Compatibility

Merger combinations range from minimal to maximum. Partner firms that are more or less autonomous characterize minimal combinations. The primary areas affected during implementation of minimal combinations are those of strategy related decisions. Partnerships that are highly interactive are considered to be on the maximum end of the scale. These affect internal management and the companies' relationship with the

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environment. Due to this, there is a greater need for compatibility of the companies (i.e., focus of authority and responsibility, personnel policies, and decision making styles).

Power differences are a major problem during the integration of cultures. Problems will be minimized if the new organizational identity is favorable and any power differentials are accepted and seen as legitimate.

Symmetrical relationships are those that are on equal terms with neither party having the power to impose its frame of reference on the other. Thus, a third culture has to be developed, and the potential for difficulties is increased. Asymmetrical relationships utilize a dominant-subordinate partner relationship to instill a common frame of reference.

In performing a *cultural evaluation*, it is important for the broker to not only consider elements such as those discussed in Table 11.4, but the broker must also consider the type of combination desired (i.e., minimal or maximum), any potential power differences, and whether a symmetrical or asymmetrical relationship is desired. As illustrated in Figure 11.8, each of these elements influences the degree to which a more compatible culture will develop. Table 11.5 reflects the refined scores for four potential partners that result from *cultural evaluations*.

Table 11.5: Example Scores After Cultural Evaluations

Potential Partner	Task Evaluations	Cultural Evaluations	Trust
A	Yes	5	3
B	No	---	1
C	Yes	4	5
D	Yes	1	2

11.7.1.3. *Compare Candidates Quantitatively*

This activity is the third step in the partner selection process (see Figure 11.7). The technique used for quantitative analysis is based on the supplier performance measurement literature. This *quantitative comparison methodology* is illustrated in Figure 11.9 and is represented as a mechanism in Figure 11.7. As seen in Figure 11.9, the broker must initially determine the general categories for measurement and the weights for each category. For example, a company may decide to measure quality, time/delivery, price, and supplier initiatives. This helps overcome the traditional pricing comparison and allows for a focus on total cost. The categorical choices are influenced (see Figure 11.9) by several key factors: customer needs/desires and thus the organization's overall business strategy, the tasks of the virtual enterprise, and whether the potential member will be a manufacturing or service partner. Next, the broker must determine the specific measurements for each category and the weight that each will carry within the category. Example measurements are discussed in sections 6.2 – 6.5 and are highlighted in Tables 11.6 (manufacturing providers) and 11.7 (service providers).

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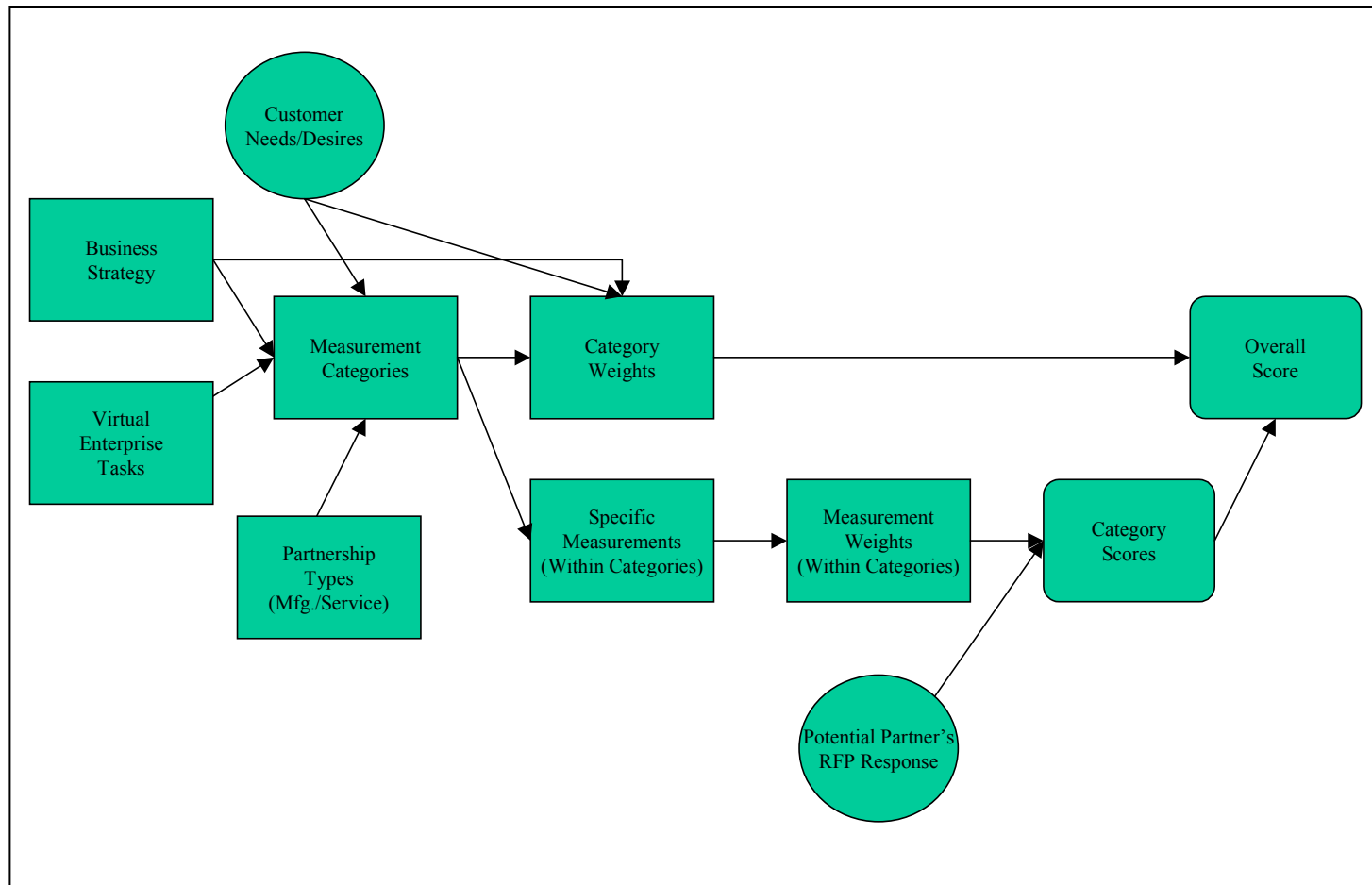
Figure 11.9: Influence Diagram of the Methodology to Quantitatively Compare Potential Partners

Table 11.6: Example Measurements Within Categories for Manufacturing Providers

Manufacturing Providers	
	Quality
	Defect Rate- the proportion of parts/products ordered that do not meet specification limits (often measured in defects per million)
	Shipping Damage- the proportion of parts that do not meet desired quality levels due to damage during shipment
	Warranty Utilization- warranty utilization rates indicate overall product quality
	Time/Delivery
	On-Time Deliveries- the proportion of orders delivered on or before the requested date
	Order Fill Rate- the proportion of orders shipped complete as ordered
	Order Lead-time- the average time from the date an order is placed until the customer receives shipment
	Cost
	Total amount spent on a specific function
	Cost as a percentage of sales
	Cost per unit of volume
	Responsiveness/Flexibility
	Order Lead Time- the average time from the date an order is placed until the customer receives shipment
	Upside Production Flexibility- the number of days needed to adapt to an unexpected 20% growth in demand [Geary and Zonnenberg, 2000]
	Downside Production Flexibility- the percentage order reduction sustainable at 30 days prior to delivery with no inventory or cost penalty [Banker and Snitkin, 2003]
	Supplier Initiatives -- variable by nature…examples include:
	Implementation of continuous improvement and quality control initiatives
	The desire to provide courteous, meaningful, and timely communications
	Cost management and reduction strategies

Table 11.7: Example Measurements Within Categories for Service Providers

Indirect/Service Providers	
Contract Compliance	
	Cost versus Budget- did the supplier perform over or under budget
	Performance Against Service Level Agreement- how does the supplier deliver relative to the service level agreement
	Return Rate- how many and how often are items returned
	Order Invoice and Accuracy- are correct orders received and priced as quoted
Customer Satisfaction	
	Customer Service
	Technical Support
Cost Competitiveness	
	Supplier Pricing versus Industry Average
	Supplier Pricing versus Other Benchmarks (e.g., other supplier quotes)
Continuous Improvement	
	Cost Reduction Targets
	Cost Reduction Recommendations
	Partnership Initiatives

Table 11.7 provides example measurements for service providers; however, categories

similar to those found in Table 11.6 might also be relevant. The criteria chosen and

respective weights should be developed prior to the development of the RFP and serve as

a foundation for the RFP document. The RFP (as discussed in section 5.5.1.2) asks

potential partners to respond to the specific requirements and other terms and conditions.

It also asks the potential partners to explain their impact on total cost and how they may

create value.

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As illustrated in Figure 11.9, the criteria and associated weights are used to evaluate the response of each organization to the RFP. An example of these computations is provided in Table 11.8.

Table 11.8: Example Supplier Scorecard

Category	Weight	Assessment	Category Score
Quality	**25%**		95.0
Defect Rate	33.33%	95	
Shipping Damage	33.33%	100	
Warranty Utilization	33.33%	90	
Time/Delivery	**25%**		93.5
On-time Delivery	50%	90	
Order Fill Rate	50%	97	
Cost	**25%**		85
Price	100%	85	
Responsiveness	**15%**		87.5
Order Lead Time	40%	95	
Upside Production Flexibility	30%	80	
Downside Production Flexibility	30%	85	
Supplier Initiatives	**10%**		75
xxxxxxx		75	
		Overall Score	**89.0**

Assessment Key	
Excellent	100
Very Good	90
Good	80
Average	70
Below Average	60
Poor	50

The quantitative comparison provides a new attribute to the scoring system as well an updated score in terms of trust. The updated scores, denoted as *Partner (Ta^1, C^1, Tr^3, Q^0)*, become an output to this step and a control to the final step of extending an offer.

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Table 11.9 denotes the updated scores for the four potential partners. Observe that Potential Partner B was not submitted to a quantitative analysis because of their inability to perform the necessary tasks.

Table 11.9: Example Scores After Quantitative Assessments

Potential Partner	Task Evaluations	Cultural Evaluations	Trust	Quantitative Assessment
A	Yes	5	4	95
B	No	---	1	---
C	Yes	4	5	90
D	Yes	1	3	80

11.7.1.4. Final Assessments and Extend Offer

The scores developed during the previous three steps are used as a guide for ranking the potential partners and developing a short list of candidates that will be submitted to a series of *concluding analyses*. For example, Table 11.10 shows how the four potential partners might rank. Potential Partner B is last because of their inability to perform the necessary tasks. Potential Partner D, while capable of performing the necessary tasks, is in third because of low scores in the remaining categories. Potential Partner C, while slightly below Potential Partner A in terms of culture and quantitative scores, actually gets the highest rank because of the elevated level of trust the broker has for the potential partner. Note that there are no set guidelines for this choice, and it is dependent on the broker's insight.

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Table 11.10: Ranking of the Four Potential Partners

Rank	Potential Partner	Task Evaluations	Cultural Evaluations	Trust	Quantitative Assessment
1	C	Yes	4	5	90
2	A	Yes	5	4	95
3	D	Yes	1	3	80
4	B	No	---	1	---

From the ranked list, the broker might choose to submit the top two potential partners to a series of concluding analyses (represented as a mechanism in Figure 11.9). *Concluding analyses* include site visits, follow up interviews, and total cost evaluations. These are used to determine the final selection, which is then recommended to top management. Once approved, final negotiations are performed, and the partnership officially begins with the signing of a contract.

11.7.2. Develop Communication

Successful relationships are built on communication. Likewise, the success of a virtual enterprise is especially dependent upon communication. Therefore, it is imperative that the broker and members of a virtual enterprise identify appropriate modes of communication that fit within the capabilities of the member organizations (see relationship #4 in Figure 11.2). As discussed in chapter 9, these modes should allow for three specific and necessary areas: *communication channels*, *collaboration media*, and *data access needs*.

Communication channels allow two or more parties to exchange information. For virtual enterprises, traditional means of communication (face-to-face, phone, etc.) are important; however, there is an increasing dependence upon technologically advanced means of communication that are computer and Internet based.

As defined earlier, collaboration is communicating so that each piece of information builds upon the other and progresses toward goals. Partners in the virtual enterprise depend upon the Internet to provide efficient and effective *collaboration media*. Ideal collaboration mediums are important because precedence relationships require independent organizations to maintain continuous interaction and cooperation with each other in order to ensure each step is ideally performed with an understanding of how it will affect the overall objectives of the enterprise.

Virtual enterprises must also ensure that the necessary information is available in a timely manner to those who need it. The ability to quickly access necessary information keeps members updated on the status of projects and provides key data for task completion. The ability to make data available, however, does not imply the necessity to allow total access. The tasks of each member determine the need for information access. This, along with proprietary concerns, results in the decision to limit data access ability to those with a defined need to access the information (i.e., a need-to-know basis).

Figure 11.10 portrays these three decisions and demonstrates that no set sequence exists in reaching the three decisions. In fact, it is possible to envision situations where any one of the three decisions could drive the remaining decisions.
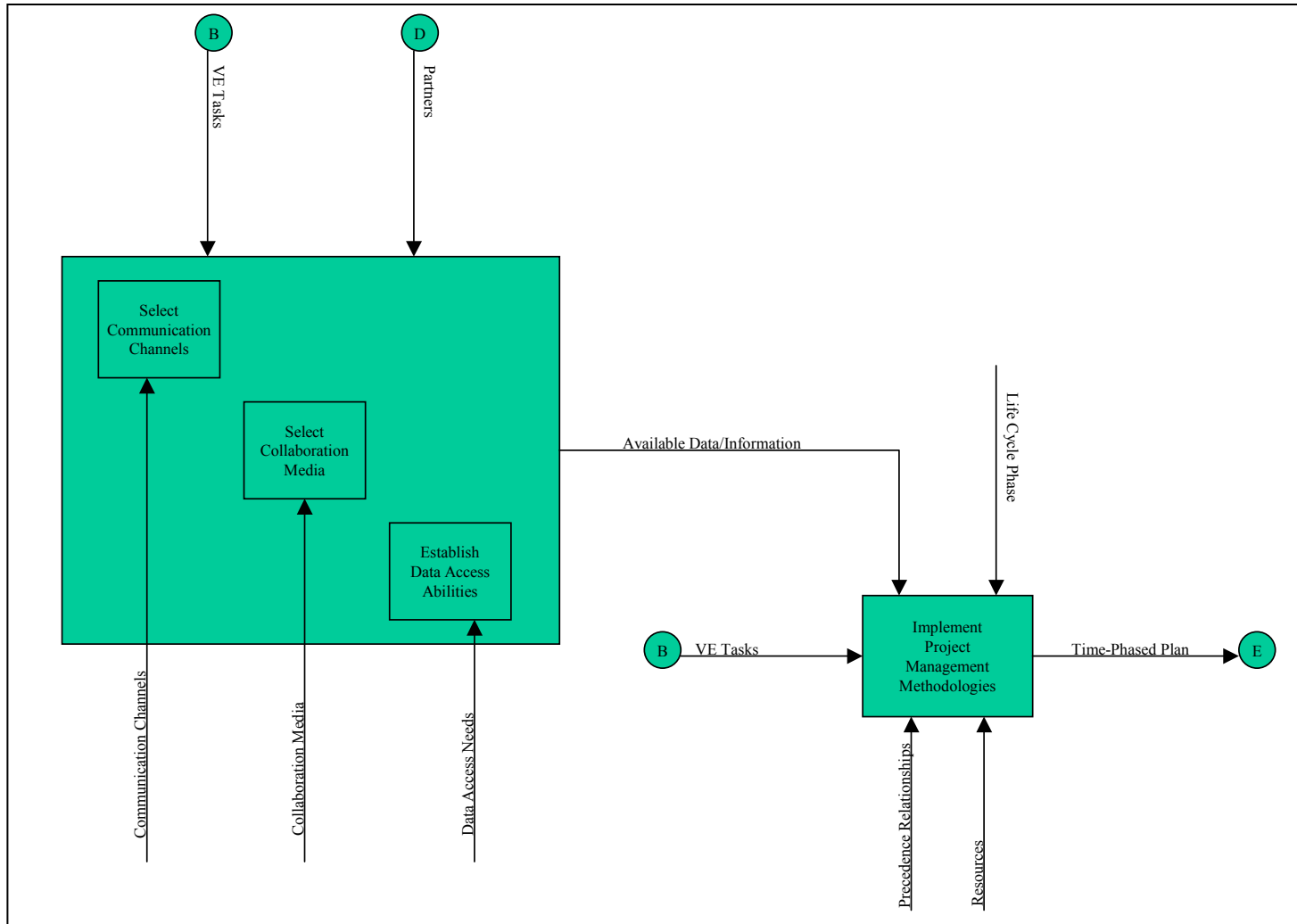
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Figure 11.10: Third Layer Diagram – Develop Communication

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Virtual enterprise success depends on the use of modes for communication, collaboration, and access to information. Success also depends on coordination. Coordination allows the three key areas of communication to effectively interact so as to successfully accomplish the objectives of the virtual enterprise. Project management is capable of providing this coordination. Similarly to the discussion on the three key areas of communication, a detailed discussion of project management and its potential impact on virtual enterprises is provided in Sections 9.2 and 9.3.

Figure 11.10 illustrates the incorporation of project management as a means for coordination in the virtual enterprise. The goal is to transform the *virtual enterprise tasks* into a *time-phased plan*. Two key mechanisms for this include: 1) the *precedence relationships* between the tasks and 2) the necessary *resources* for the tasks as well as the times the resources are to be made available.

In conjunction with the application of these mechanisms, the broker must identify the most relevant project management process (discussed in Section 9.2.5). The *life cycle phase* of the virtual enterprise (represented in Figure 11.10 as a control) influences the decision of which project management process is the most applicable. As shown in Table 9.2, the virtual enterprise life cycle is related to the project life cycle. The project management processes, as discussed in Section 9.2.5, depend on the phase of the project itself. (Because this research focuses on the development of a virtual enterprise, the first two phases of the virtual enterprise life cycle (identification and formation), the first two phases and parts of the third phase of the project life cycle (conception, definition, and

acquisition), and the first two project management processes (initiation and planning) are relative.) The project management process influences the decision to use certain tools of project management. These tools, as discussed in Section 9.2.4, include Work Breakdown Structures (WBS); Responsibility Matrix; Events and Milestones; Gantt Chart; Networks; Critical Path Analysis; Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM); Cost Estimating, Budgeting, and Forecasting; Risk Assessment; Critical Chain; and Multi-Project Management. (Because this research focuses on the development of a virtual enterprise, the most useful tools include the WBS, Responsibility Matrix, Events and Milestones, Gantt Chart, Networks, and Critical Path Analysis (possibly also PERT and CPM). The remaining tools are also potentially useful but are probably most relevant to highly sophisticated/advanced enterprises.) Through the use of these tools, the broker is able to develop a well-defined plan for accomplishing the tasks of the virtual enterprise in a timely manner in order to better respond to the identified customer needs.

11.7.3. Develop Culture

Culture plays a major role in the success of a virtual enterprise. Cultural assessments prior to partnership (see relationship #3 in Figure 11.2) expose the broker to characteristics of its potential partners that may place a partnership at risk. [Horwitz, et al., 2002] Beyond partnership, it is necessary to implement cultural development activities in order to ideally integrate the *partners' cultures* (see relationship #5 in Figure

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11.2) and increase the probability of success. As indicated in Figure 11.11, effective cultural integration activities include: establish credible leadership; define expected culture; establish strategy, objectives, values; develop incentives and control systems; and develop socialization activities.

11.7.3.1. Establish Credible Leadership and Define Expected Culture

A vital step in the cultural integration process is the establishment of credible leadership. The nature of the virtual enterprise (and the *virtual enterprise environment*) must be considered when determining those best suited for leadership positions. In addition, the *time-phased plan* is a control (see Figure 11.11) that influences those suited for *leadership*. This is because there may be a need for certain individual abilities in order for one to effectively lead in the areas necessary to accomplish the objectives of the virtual enterprise. Once selected, the leaders are responsible for defining the *expected culture* of the virtual enterprise.

The central values and beliefs of an organization begin with a vision and a mission. With the vision and mission is a set of expectations on how the virtual enterprise will operate to achieve the vision. Communication is the vehicle that transmits cultural *expectations* (see relationship #6 in Figure 11.2) throughout the virtual enterprise. [Grabowski and Roberts, 1999] Therefore, interface communication should encompass all aspects of organizational culture. These include all values, beliefs, processes, rationales behind decisions, roles and responsibilities, and managerial expectations.

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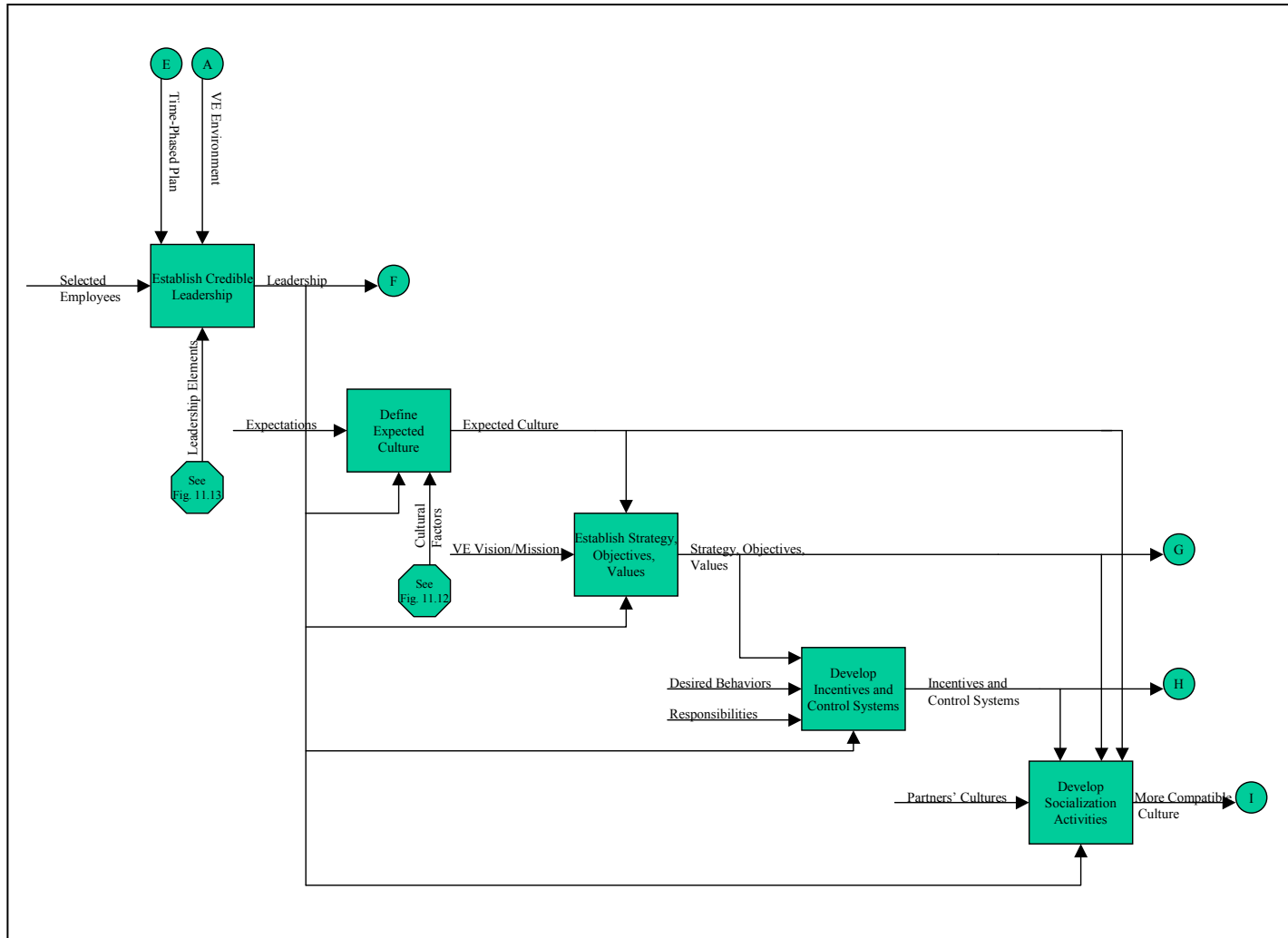
Figure 11.11: Third Layer Diagram – Develop Culture

Figure 11.12 (represented as a mechanism in Figure 11.11) depicts the influence of each factor on the overall goal of communicating cultural expectations. Leadership must effectively communicate expectations throughout the enterprise.
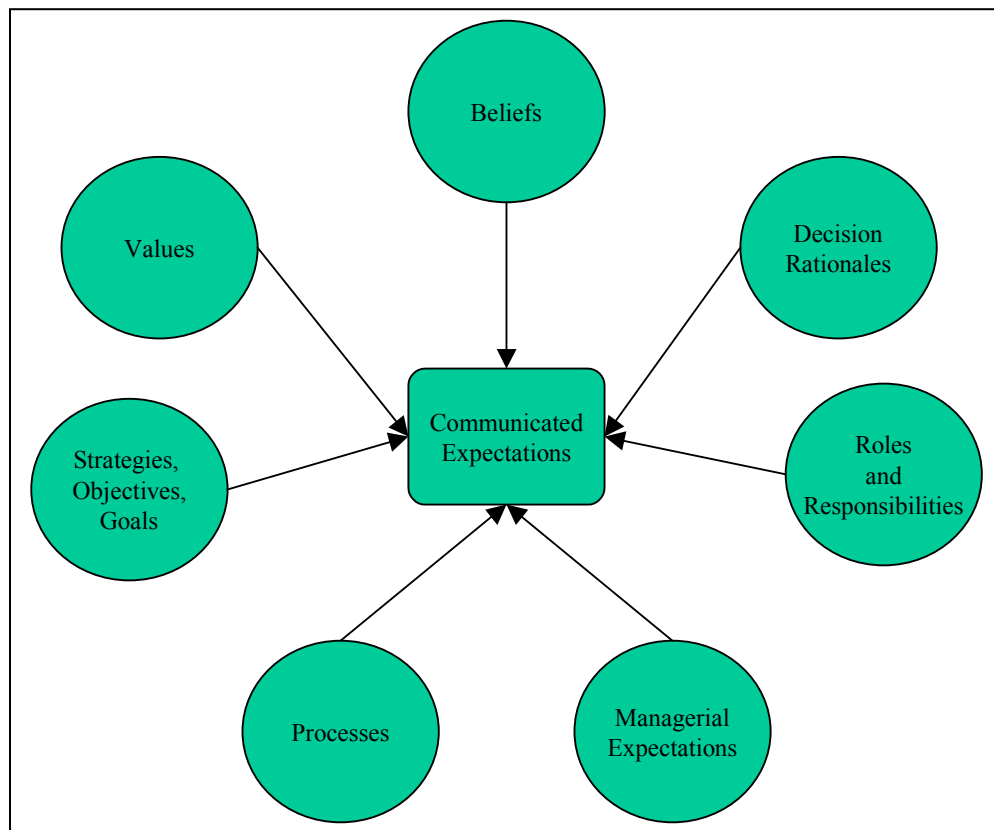
Figure 11.12: Integrating Cultural Expectations

Once these expectations are communicated, it is also necessary for the leadership to reinforce the communications with actions. This is important because leaders symbolize the new identity and set procedures that determine the culture of the virtual entity. The influence of leadership on cultural development is illustrated in Figure 11.13 and is

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represented as a mechanism in Figure 11.11 for the activity "establish credible leadership." The leadership decisions influence the type and degree to which verbal actions and physical behaviors are utilized. This is important because both the verbal actions and the physical behaviors of those in leadership positions set the precedent for norms. The norms filter down through the virtual enterprise and affect the overall cultural integration process. See Section 7.7.5 for recent examples of leadership's influence on an organization's culture.
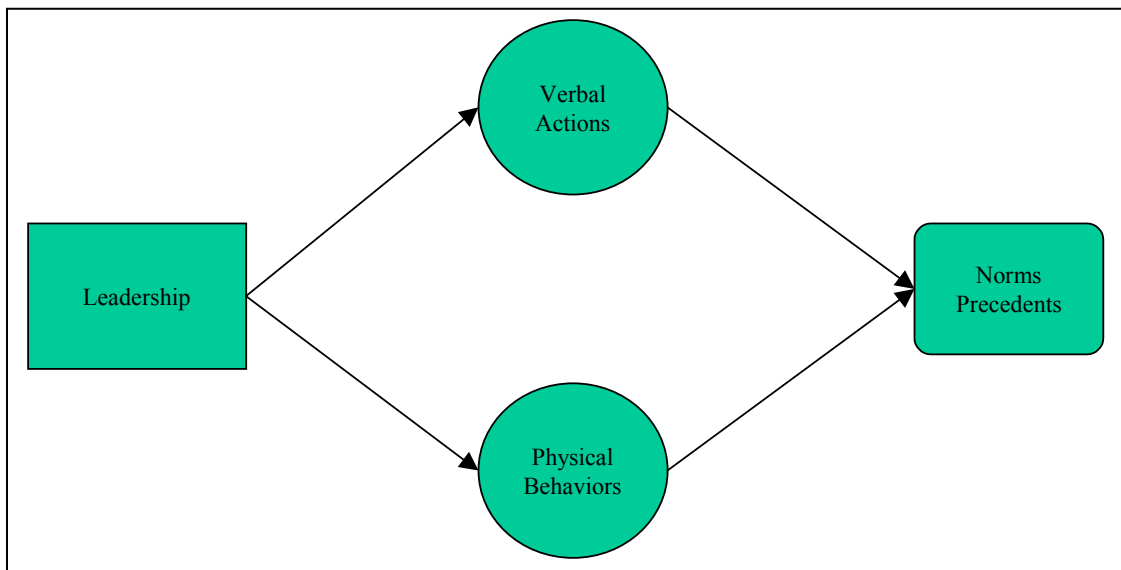
Figure 11.13: Leadership's Influence on Cultural Development

11.7.3.2. Establish Strategy, Objectives, Values

There must be a win-win situation for those involved with the virtual enterprise. While the broker essentially envisions the use of the virtual enterprise to meet some

market need, the chosen partners should mutually benefit from participation. *Leadership* is responsible for transforming the *virtual enterprise vision and mission* of the broker to a mutual set of *objectives, strategies* for achieving objectives, and *values* that will not be sacrificed. The result is a unified team and not an "us against them" attitude.

11.7.3.3. Develop Incentives and Control Systems

The culture desired for the virtual enterprise creates expected norms of behavior (i.e., a *desired behavior*) and *responsibilities* that promote the achievement of objectives. Proper *incentives and control systems* foster the alignment of behavior with the objectives of the organization. *Leadership* bears the responsibility for establishing proper incentives and control systems and greatly influences cultural integration therewith. Figure 11.14 is an influence diagram depicting these relationships, and it illustrates the impact this activity plays in the overall goal to develop a *more compatible culture* (as seen in Figure 11.11).

11.7.3.4. Develop Socialization Activities

While leadership by example and proper communication of expectations play important roles in exposing employees to cultural views, an excellent way to effectively integrate culture is through "hands-on" activities. The best way to learn is through experience. Socialization activities allow employees to physically experience the cultural desires of the virtual enterprise's leadership. Example activities include training, task forces, transition teams, and even celebrations that symbolize the organization's positive

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transition. These activities are guided by and reinforce the cultural expectations; strategy, objectives, and values; and incentives and control systems of the virtual enterprise. The result is a transformation of the *partners' cultures* into a *more compatible culture*.
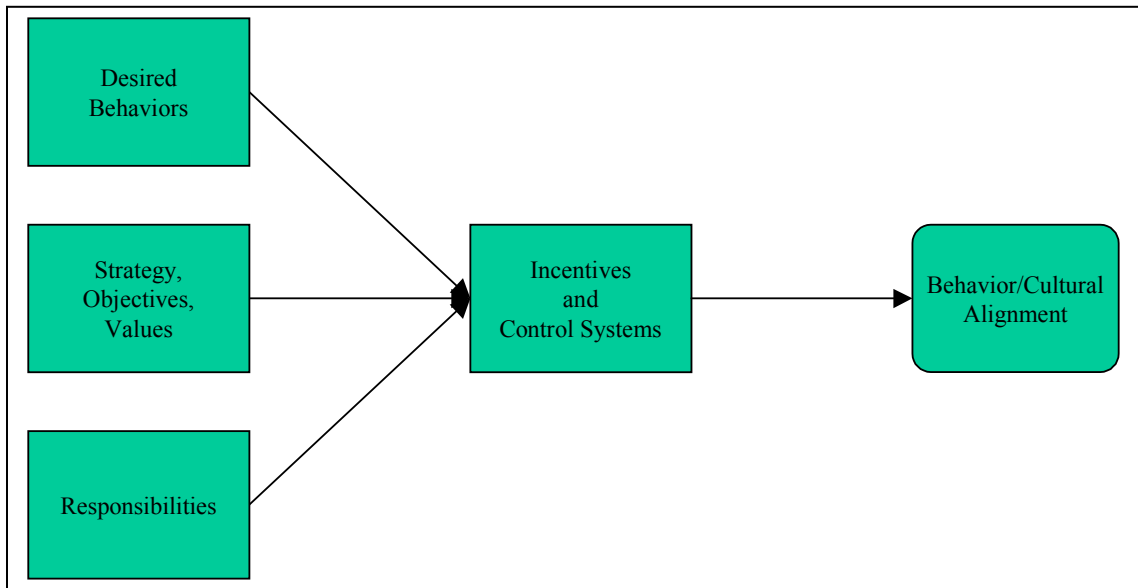
Figure 11.14: Aligning Behavior and Culture Through Incentives/Control Systems

11.7.4. Develop Trust

Trust is built over time. The changing nature of virtual enterprises imposes a necessity for swift establishment and maintenance of trust between member organizations. Partner selection decisions occur, in part, because of some initial trust level in the organization (see relationship #2 in Figure 11.2). The reputation of the broker for assembling trustworthy organizations also plays a role in the trust between member organizations (see relationship #7 in Figure 11.2). Beyond the initial levels of

trust, it is vital that the organizations continue to strengthen the trust between one another throughout the life of the virtual enterprise. Activities that contribute to trust include communicating socially and vocationally, establishing a team focus, developing mutual objectives, and successfully completing daily responsibilities. These are portrayed in Figure 11.15.

11.7.4.1. Assess Trust Levels

Partnership decisions occur due to some initial level of trust that the broker organization possesses in the partner organizations. Factors that influence this initial trust (as illustrated in Figure 11.16 and discussed in Section 8.2) include former relationships between the organizations, changes in the organizations since the previous relationships, an organization's reputation, the importance of the outsourced task, mutual organizational values, and the possession of appropriate information technology. (Figure 11.16 is represented as a mechanism in Figure 11.15.) Beyond these factors, which are considered prior to the partnership decision, certain other factors also influence trust levels in the early stages of the virtual enterprise. One of these factors is the degree to which a *more compatible culture* is developed (see relationship #8 in Figure 11.2). Organizations that hold similar values and beliefs and hold common ideas on the management of the virtual enterprise will naturally possess higher levels of trust than those with less compatible cultures. *Contractual relationships* also instill trust, to a
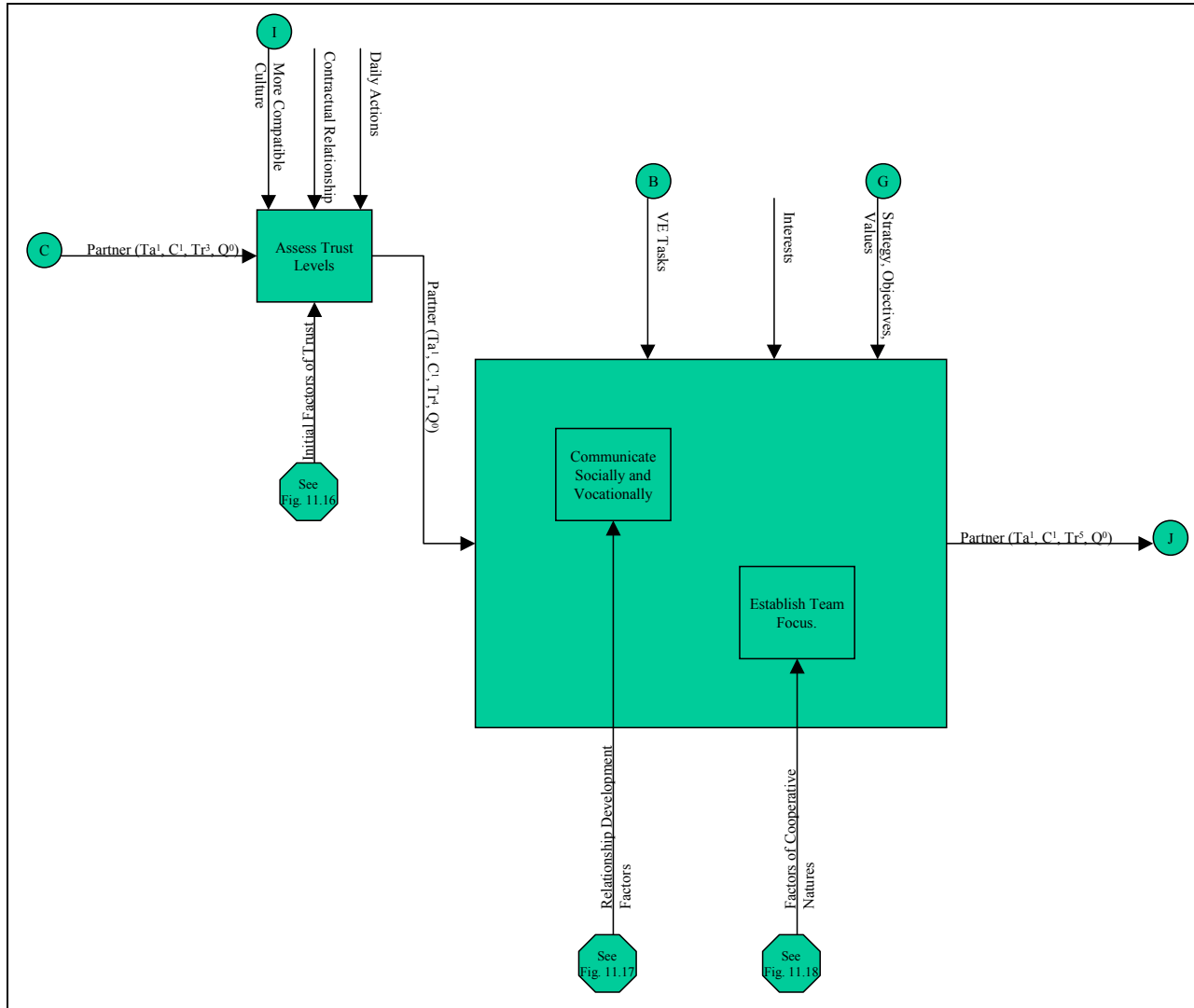
Figure 11.15: Third Layer Diagram – Develop Trust
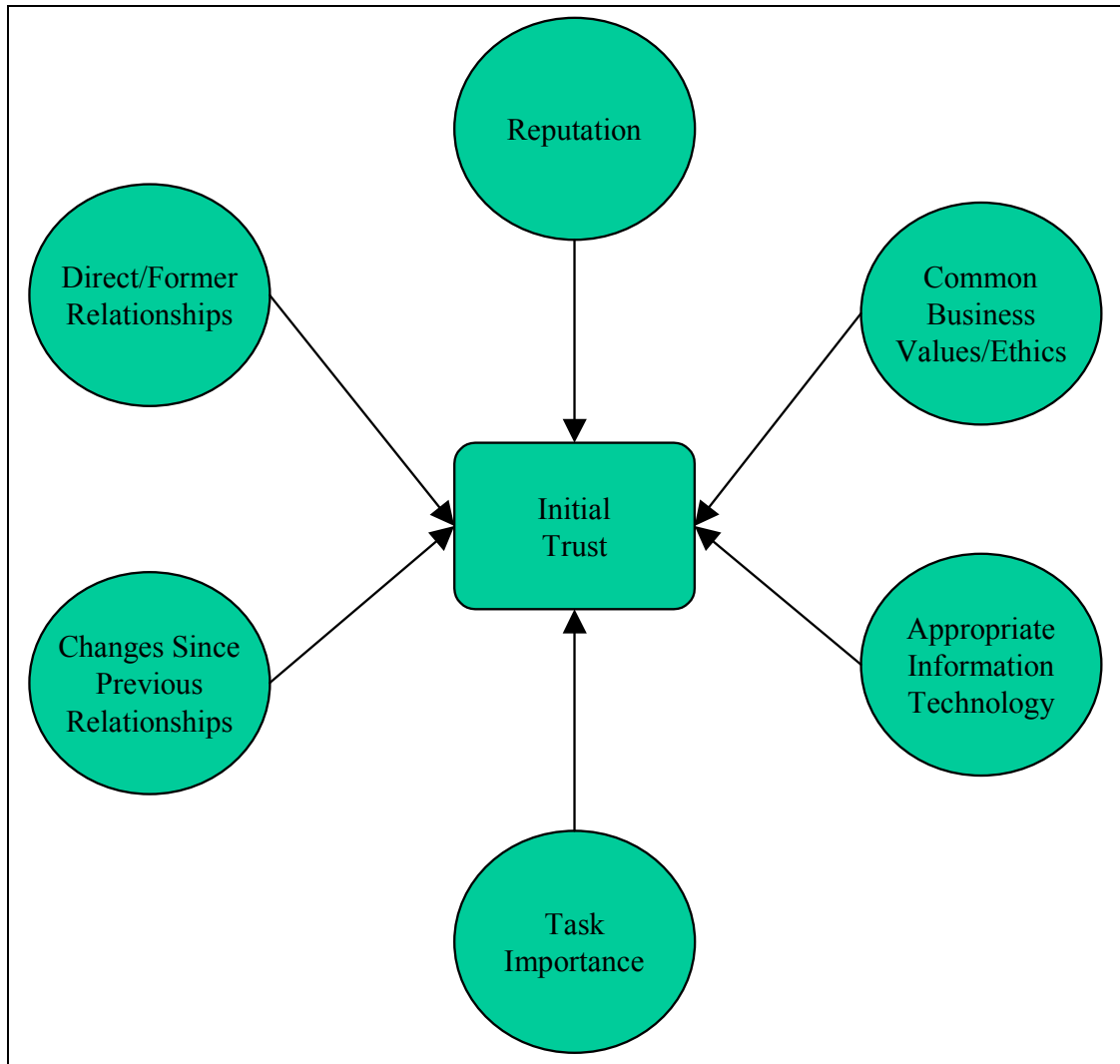
Figure 11.16: Factors that Influence Initial Trust

certain degree, because of the nature to which expected behaviors are controlled by

punishment for unexpected behaviors. Finally, the *daily actions* of the members of the

virtual enterprise act as a control to trust levels. Exhibited behaviors influence opinions

of others and the current level of trust one has for others. Trust is increased when parties accomplish duties successfully and on time. With these actions, parties prove they are trustworthy. The assessment of these factors produces a new insight on the current trust levels. The attribute, *Partner (Ta^1, C^1, Tr^3, Q^0)*, is transformed to *Partner (Ta^1, C^1, Tr^4, Q^0)* where "Tr^4" represents the new level of trust. The new trust level will be refined further (resulting in the output, *Partner (Ta^1, C^1, Tr^5, Q^0)*) through two key activities: communicate socially and vocationally and establish team focus. Please note that these two activities are represented in the IDEF0 diagram as having no set sequence. This is because each activity should reinforce the other throughout the life of the virtual enterprise.

11.7.4.2. *Communicate Socially and Vocationally*

Communication serves as a major factor in developing trust (see relationship #9 in Figure 11.2). The cultivation of positive relationships promotes trust among members of the virtual enterprise. Communication should occur vocationally as well as socially. In fact, social communications serve as ideal building blocks for vocationally trusting relationships. As social relationships grow, employees are more willing to trust one another and cooperate on work-related tasks. Figure 11.17 is an influence diagram, based on Jarvenpaa and Leidner [1998]. They state that trust is facilitated by both communication and member actions that take place in the early and latter stages of the group's life. They say that trust develops early in a group's life because of social

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communication (discussing activities, hobbies, etc.) and communication that conveys enthusiasm about completion of the task at hand. Early member actions that facilitate trust include coping with technical and task uncertainty and members showing individual initiative (suggestions, volunteering, etc.). Trust is maintained later on in the group's life by predictable communication and by substantive and timely responses. Finally, member actions that maintain trust beyond the early stage of a group's life include leadership, transition from a procedural to task focus, and phlegmatic responses to crisis. Figure 11.17 acts as a mechanism in Figure 11.15.
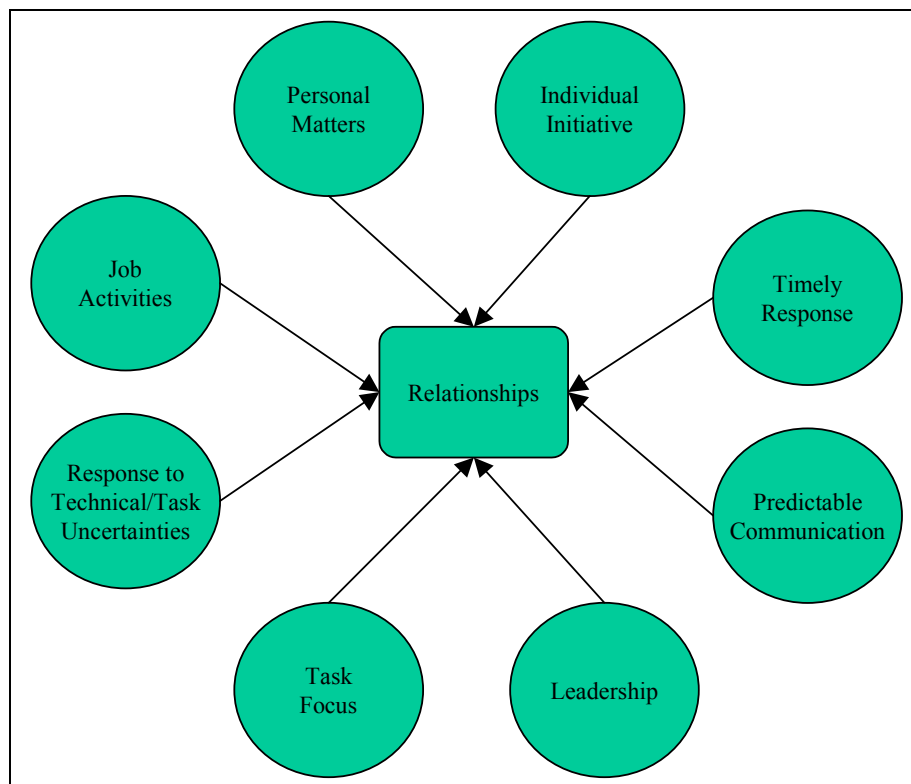
Figure 11.17: Factors Influencing the Development of Relationships

11.7.4.3. Establish Team Focus

An important factor in successful virtual enterprises is that the individual members work together as a team. Members that are cooperative and team focused often exhibit key characteristics that promote trust. These characteristics and their influence on cooperative natures are illustrated in Figure 11.18 and include (but are not limited to) dependability, honesty, competence, customer orientation, and likeability. [Swan, et al., 1988] In addition, the manner in which decisions are made, the degree of group input utilized for cooperative tasks, and the way in which conflicts are resolved play a key role in the development of cooperative natures and the promotion of trust. Note that Figure 11.18 is represented as a mechanism in Figure 11.15.

11.7.4.4. Strategy, Objectives, Values

The establishment of a mutual *strategy, objectives, and values* was discussed in Section 11.7.3 ("Develop Culture"). This activity also contributes to the overall goal of trust development and serves as a control to the activities of "communicate socially and vocationally" and *"establish team focus"*. Mutually developed strategy, objectives, and values align the focus of each enterprise on outcomes that benefit the virtual enterprise as a whole rather than on personal outcomes that negatively affect the other members. The result is a heightened sense of trust between the members because each party has committed to achieve a common purpose.
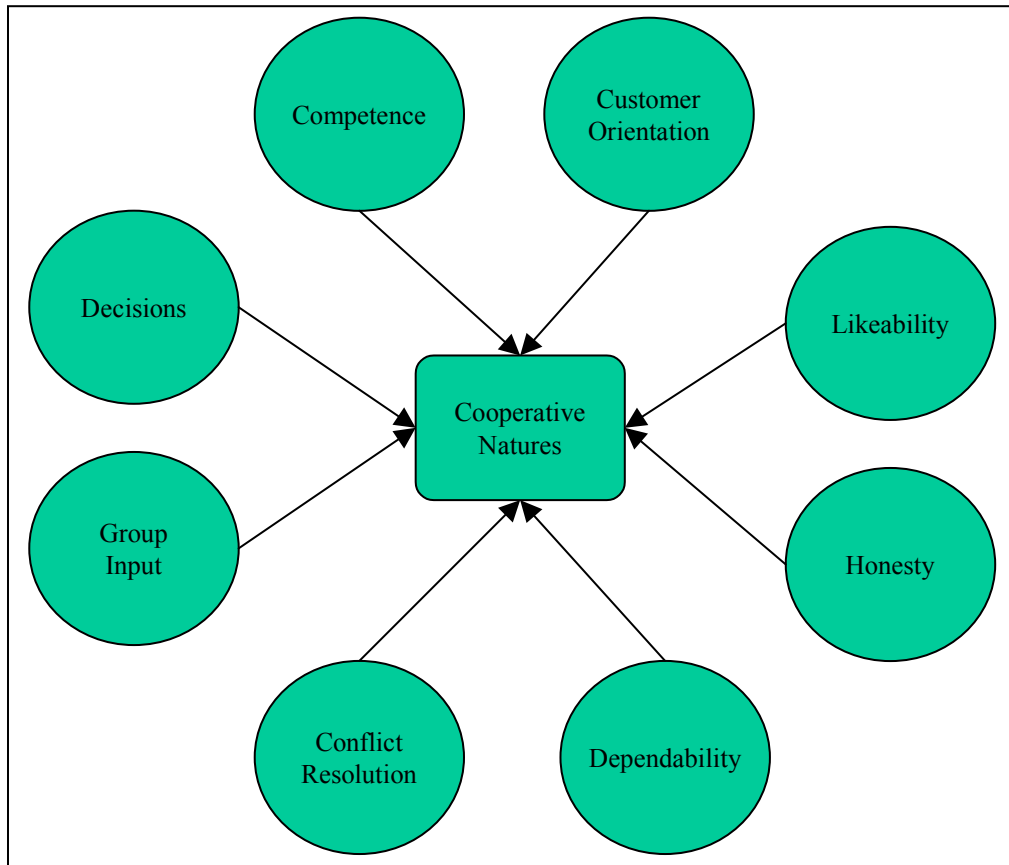
Figure 11.18: Key Factors that Influence Cooperative Natures

11.7.5. Enhance Behavior Through Motivation

By nature, motivation is a situational task. The individual differences in people contribute to differences in how one is motivated (see relationship #10 in Figure 11.2). The art of motivation depends on properly identifying these differences and appropriately

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considering them in the motivation process. In addition to understanding individual motivation, there are foundational concepts that serve as building blocks to motivate. These concepts and their relationships, as seen in Figure 11.19, are discussed next.

11.7.5.1. Develop Hands-On Leadership

Leadership must play an active role in the motivation process within the virtual enterprise. The thought of motivational leaders often brings to mind memories from the sporting world. For example, Knute Rockne's "Win One for the Gipper" speech is considered motivational. In addition to the speech, however, the players' motivation was also built on the amount of time that Coach Rockne spent with his players on the practice field. The hands-on instruction instilled trust into the players that the coach's decisions were in the best interest of both the individual players and the team as a whole. The trust, in turn, led to higher levels of commitment, motivation, and performance.

The type of leadership described above also applies and is especially important to virtual enterprises whose members are geographically separated. The leaders of the virtual enterprise possess the potential to greatly impact motivation among member organizations as they complete the tasks of the virtual enterprise. In Figure 11.19, note that the *virtual enterprise tasks* act as a control to the activity, "utilize hands-on leadership". This is because *hands-on leadership* promotes the accomplishment of the tasks. The degree to which hands-on leadership is successful depends on the degree to which the leaders not only verbally lead, but also the degree to which they reinforce their ideas through actions. Figure 11.20 is an influence diagram showing that effective

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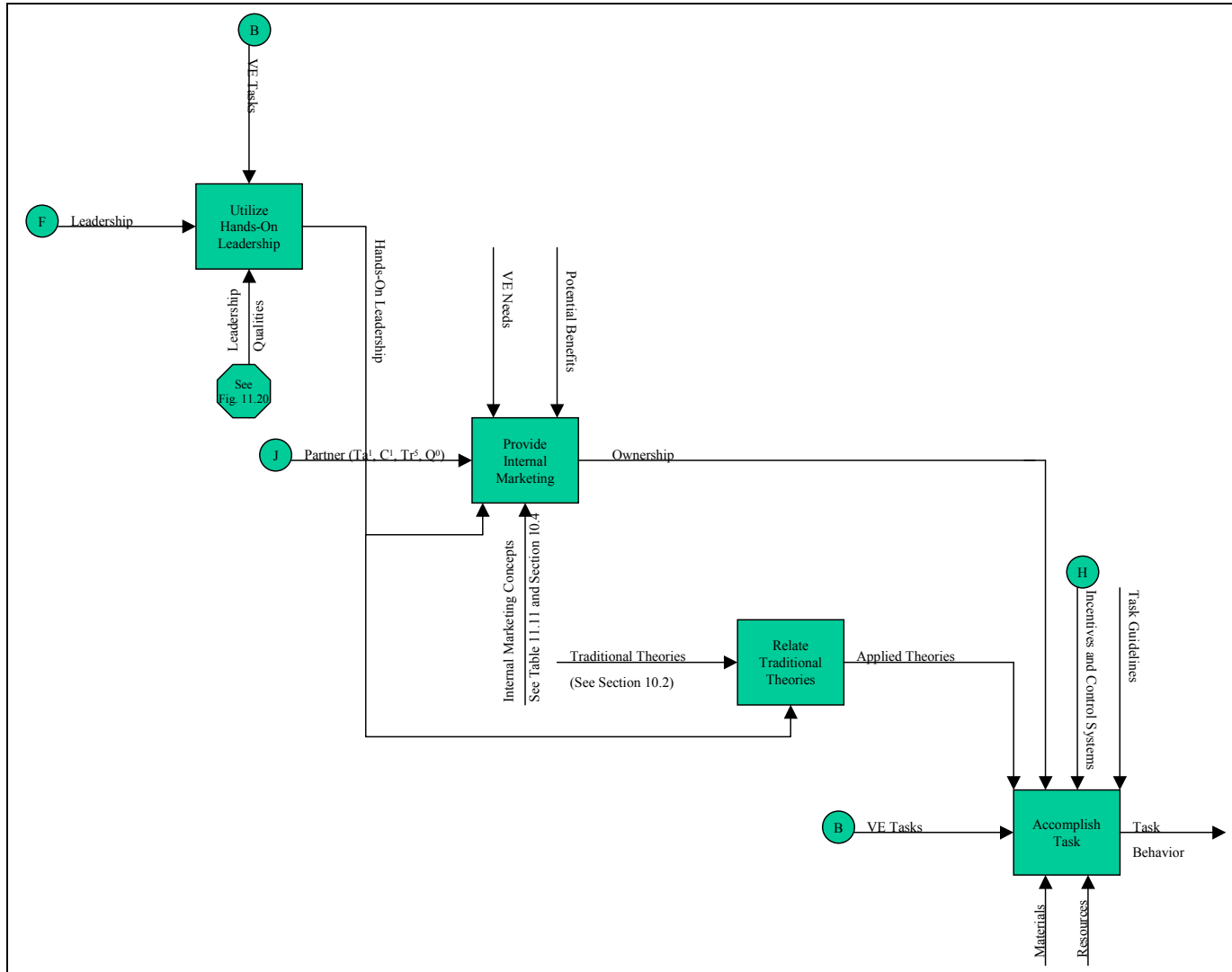
Figure 11.19: Third Layer Diagram – Enhance Behavior Through Motivation

leadership starts with a personal vision for how to lead the enterprise. As expressed in Robbins [1998], leaders then exhibit three key qualities. First, leaders possess the ability to clearly explain (orally and through writing) their vision to others. Second, they express the vision through behavior. That is, their actions convey and reinforce the vision. The third quality is the ability to convey the importance of the vision for each area of the business. Marketing, research and development, etc., must all see why the vision is meaningful. As illustrated in Figure 11.20, the combined influence of these three key areas impacts the overall effectiveness of hands-on leadership. Note that Figure 11.20 is a mechanism in Figure 11.19.
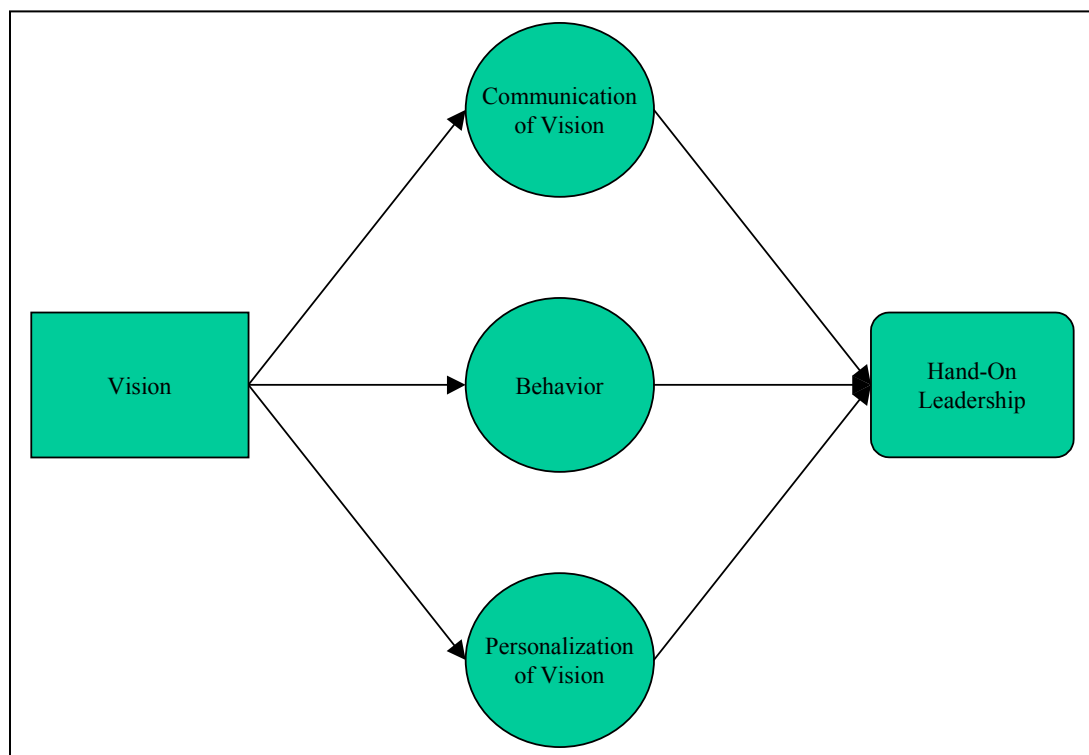
Figure 11.20: Three Key Qualities that Influence Effective Leadership

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11.7.5.2. Develop Trust

Though motivation is not solely dependent upon trust, trust certainly promotes motivation. Trust development (discussed in Section 11.7.4) adds credence to the virtual enterprise and further inspires the individual organizations (see relationship #11 in Figure 11.2). The role of trust in the motivation process is illustrated in Figure 11.19 as an input to the activity "provide internal marketing".

11.7.5.3. Provide Internal Marketing

Unless the members see themselves as integral contributors to the success of the virtual enterprise, it is unlikely that ownership will result. Therefore, it is essential to convince each member that they are vital components in the virtual enterprise and to promote the *potential benefits* for each member that result from the virtual structure. As referenced in Figure 11.19 and identified in Table 11.11, examples of *internal marketing concepts* include the joint development of goals, developing an intranet as a secure and common communication channel, providing opportunities for face-to-face interactions, and conveying the corporate identity. [Weisenfield, et al., 2001] Each of these (discussed in Section 10.4) creates ownership in the virtual enterprise, and the ownership contributes to the motivation process. The *ownership* (represented as an output) serves as a control to the accomplishment of the task.

Table 11.11: Examples of Internal Marketing Concepts [Weisenfield, et al., 2001]

Belief Systems (Missions, Strategies, and Values)
• Organizational Intranets
• Opportunities for Face to Face Interactions
• Communication of the Corporate Identity

11.7.5.4. Relate Traditional Theories of Motivation to Employees

The *traditional theories* of motivation serve as a foundation to the explanation of employee motivation. Each of these theories is discussed in Section 10.2.

Because motivation is a function of an individual and the environment, the validity of certain theories depends on a consideration of the interaction of the individual and the environment in which he/she is placed. When applied, the theories also serve as a control to the activity, "accomplish task".

11.7.5.5. Develop Incentives and Control Systems

Proper *incentives and control systems* promote the alignment of behavior with the objectives of the organization. Incentives and control systems were discussed previously in Section 11.7.3.3. In addition to their role in developing a more compatible culture, incentives and control systems create healthy competition and stimulate the desire to improve performance. *Incentives and control systems* are denoted in Figure 11.19 as a control to the "accomplish task" activity.

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11.7.5.6. Accomplish Task

Proper motivation results in an increased desire to improve performance. It is the goal of the broker to have each member complete the *virtual enterprise tasks* (represented as an input in Figure 11.19) in such a way that a desired *task behavior* is achieved (represented as an output in Figure 11.19). The mechanisms for completing the tasks include any necessary *materials* and *resources*. It is the controls to this step that, while not a necessity for completing the task, represent the extra incentive to perform at a higher level. *Ownership*, *applied (motivational) theories*, and *incentives and control systems* all serve as controls to the "accomplish task" activity. Each of these was discussed previously, and they provide the foundation for motivation. The final control is the *task guidelines*. Again, these are not necessary but definitely improve one's ability to complete a task.

11.8. Primary Relationships Between the Five Management Activities

Figure 11.2 depicts the primary relationships between the five management activities. These relationships are revealed and substantiated in the previous sections of this chapter. A brief synopsis of these relationships is as follows:

- Relationships 4, 6, 8, and 11 (respectively) represent the logical progressions of activities that must occur in order to properly develop a virtual enterprise. This ordering is also characterized in the top-level IDEF0 diagram (Figure 11.6).

- Relationship 3 is based on the need for a pre-partner cultural assessment of potential partners.

- Relationship 2 characterizes the important impact of trust on partner selection. Trust plays a major role in the partner selection process. In fact, trust is a component of the partner attribute scoring system developed in Section 11.7.1.

- Relationship 1 symbolizes a broker's desire to select partners that are highly motivated to achieve the objectives of a virtual enterprise. The knowledge, whether through previous partnerships or through reputation, of a potential partner's motivation level plays a role in the partner selection decision.

- Relationships 4, 5, 7, and 10 signify the need to address, as well as the degree to which brokers have to address, problems (within the management activities) after the partner selection decision. Good partnership decisions diminish the degree to which problems arise in these activities.

- Relationship 9 denotes the impact of communication on trust. The trust development process depends on communication between the members of the virtual enterprise. Members of the virtual enterprise that communicate socially and vocationally build relationships and trust for one another.

11.9. Summary

Increased customer service, better quality, access to resources and larger markets, flexibility, and a quick time to market are examples of the benefits expected from the use

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of virtual enterprises. Virtual enterprises also face potential problems because of the temporary and fast-response natures of the partnerships. This research has shown that key problems arise in five management activities: select partners, develop communication, develop culture, develop trust, and enhance behavior through motivation. This research has also shown that relationships exist among the activities. For the brokers, this is important because they not only need to understand the problems within the key activities but also need to understand the key relationships between the activities. Possessing this knowledge allows the broker to develop a better virtual enterprise by proactively addressing potentially major problems.

In order to illustrate these relationships, this chapter uses two standard diagramming techniques: IDEF0 and Influence Diagrams. These diagrams, by nature, address different types of situations. IDEF0 is a diagramming technique used for identifying activities that must occur in order to accomplish some overall objective. Influence diagrams are used to represent decision problems. The brokers of virtual enterprises obviously must make a number of critical decisions in order to proactively address the primary interface management problems. This research, however, has also shown that a key factor in proactively addressing the interface management problems is that brokers must organize certain activities in a manner so that the interaction of the activities leads to certain identified objectives: ideal partner selection, effective communication, a more compatible culture, and increased levels of trust and motivation. Therefore, both

methodologies are utilized to complement one another and more fully capture the primary

relationships between the management activities.

CHAPTER XII

SUMMARY AND CONCLUSIONS

12.1. Summary

Today's business environment demands a quick response to changes in customer
needs while it also applies pressures to keep costs low and compete in a global economy.
In order to meet these needs, many are turning to virtual enterprises. Despite the
increasing popularity of virtual enterprises, mature practices for conducting these types of
ventures have not been developed. More specifically, there is a great need for brokers to
focus on problems that arise in the following key management activities: select partners,
develop communication, develop culture, develop trust, and enhance behavior through
motivation.

This research helps address these problems by identifying primary relationships
between the five management activities. The primary relationships are utilized to
develop a conceptual model for systematically developing a virtual enterprise. As a part
of the conceptual model, this research applies concepts from other disciplines for
attacking related problems. For example, a partner selection methodology is developed,
in part, utilizing information from the supplier performance measurement literature. In
addition, systems engineering concepts are used as a means to systematically plan and

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design a virtual enterprise. A pre-partner cultural assessment and post-partner cultural development process is created using ideas found in the literature on mergers. Finally, project management methodologies are utilized as a means for coordinating the activities in the virtual enterprise.

In addition to the accomplishments just described, this research also provides a more detailed view (than is currently available) of the primary characteristics of a virtual enterprise. Included in this is a definitional process that condenses numerous authors' definitions into a more comprehensive definition. Furthermore, this research develops a typology of virtual enterprises and shows that each type is more susceptible to certain problems than others. The typology includes need based virtual enterprises, objective based virtual enterprises, and culture based virtual enterprises.

12.2. Conclusions

This research into the underlying concept of virtual enterprises and key management activities for addressing common problems experienced during virtual enterprise formulation results in the following conclusions. First, virtual enterprises, while often defined from a general perspective, are not all the same. In fact, this research has shown that there are three basic classifications of virtual enterprises: need based, objective based, and culture based. In addition, the nature of each classification makes them more susceptible to certain problems.

Second, brokers can improve the likelihood of a virtual enterprise's success by proactively addressing key problems through the use of a systematic development process. The systematic development process created in this research appropriately considers and is based upon primary relationships (identified in this research) between key management activities that address common problems inherent in virtual enterprises.

Third, virtual enterprises can benefit by incorporating (into the development process) ideas from diverse fields of knowledge. This research illustrates the potential for virtual enterprises to apply systems engineering to the design of virtual enterprises, the concepts of supplier performance measurement to the partner selection process, the knowledge on mergers to the cultural assessment and development process, and project management to the need of virtual enterprises for proper coordination of activities.

Fourth, the ability to successfully operate a virtual enterprise depends, in part, on properly balancing the need to organize in a quick manner with the need to perform appropriate steps to ensure the compatibility between potential future partners.

Fifth, businesses of any size can potentially benefit from a virtual partnership. Large organizations typically possess the knowledge and resources to respond to market opportunities; however, they are hindered by their natural tendency to be slow in terms of change and response. Virtual enterprises provide large organizations with a unique opportunity to quickly network with other organizations and rapidly respond to the environment. Alternatively, small and medium enterprises (SMEs) often lack the knowledge and funds that are necessary to exploit market opportunities. Virtual

organizations create an environment where SMEs are able to pool resources and effectively respond to changes in the market.

Finally, the systematic framework developed in this research provides a solid foundation for future research into the design, development, and operation of virtual enterprises. Its findings and methodologies provide a point of departure for exploring a variety of important issues and improving the performance of virtual enterprises.

12.3. Future Research

The findings from this research lead to several topics for future research in the investigation of virtual enterprises. First and foremost, there is a need to apply the methodology developed in this research to a virtual enterprise. Ideally, a broker of virtual enterprises that has experienced problems in each of the areas should test the methodology. This would provide for a better understanding of the ability of the methodology to benefit the brokers of virtual enterprises. Second, it is assumed that the methodology developed in this research is robust enough to address the problems that arise in any of the types of virtual enterprises that are identified. Future research should, however, test this assumption. Next, there is a need to continually strive to develop more effective partner selection methodologies. Partner selection is the most important part in the development of a virtual enterprise. A misguided selection could result in significant financial losses as well as failure of the virtual enterprise to survive. Reciprocal effects could even damage the broker's reputation and ability to ideally organize partners when

future opportunities arise. Finally, there is a need to aid brokers in the partner search process. Large-scale opportunities abound to develop databases of organizations that desire to participate in virtual structures. The databases could allow brokers to more quickly and more effectively search for organizations that possess desired core competencies as well as those that are located in desired geographical areas.

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APPENDIX A

INDIVIDUAL CITATIONS OF THE BENEFITS OF

VIRTUAL ENTERPRISES

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Ansley, 2000
- Higher profit margins
- Greater benefits in terms of return on invested capital
- Faster time-to-market
- Quick geographic expansion
- Increased flexibility in being able to increase or decrease production rates
- Specialization of partners on their core competencies

Bleecker, 1994
- Better products
- Higher quality
- Improved time-to-market
- Higher returns on bottom line
- Personalization of products to customers
- Globalization

Cascio, 2000
- Reduced real estate expenses
- Increased productivity
- Higher profits
- Improved customer service
- Access to global markets
- Environmental benefits

Christie, et al., 1998
- Higher profitability
- More efficient use of time
- Less individual investment (resources, space, tools, development time)
- Focus on core competencies
- Manufacturing flexibility (respond quickly)
- Operation flexibility (partnerships are not long lasting)
- Better products

Desanctis and Monge, 1999
- Greater adaptability
- Faster response time to market demands
- Task specialization by partners
- Greater geographical reach

Eschenbacher, et al., 2001
- Competence bundling
- Minimization of structural costs
- Flexibility of configuration
- Motivating factors such as competence demand/self-confidence/self-esteem
- Co-ordination factors such as networking/trust

Fitzpatrick and Burke, 2000
- Lower production costs
- State of the art technologies
- Distribution infrastructures
- Avoid excess fixed costs
- Avoid asset inflexibility
- Avoid low liquidity

Grabowski and Roberts, 1999
- Greater adaptability
- Better flexibility
- Increased ability to respond quickly to market changes

Mowshowitz 1997, Snow et al., 1996 (in Jarvenpaa and Leidner, 1999)
- Better flexibility
- Increased responsiveness to customer needs
- Lower costs
- Improved resource utilization

Kernohan, 1999
- Leverage strengths of individual members
- Increase responsiveness to customers
- Streamline flow of goods and services to the end consumer
- Make more informed decisions
- Adapt to changing market conditions and consumer tastes more quickly than competitors
- Extend reach through the market

Strader, et al., 1998
- Adaptability, flexibility, agility, and speed of a small company
- Resources available due to each partner firm
- Allows partners to concentrate on their "core competence"
- Ability to globalize

APPENDIX B

INDIVIDUAL CITATIONS OF THE DISADVANTAGES

OF VIRTUAL ENTERPRISES

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Cascio, 2000
- Setup and maintenance costs
- Loss of cost efficiencies
- Cultural issues such as clashes between members
- Feelings of isolation by workers that do not have social interaction with supervisors, co-workers, etc
- Lack of trust in co-workers to fulfill their obligations

Christie, et al., 1998
- Partner access to trade secrets, technology, and data
- New type of workers needed (power and authority play lesser roles)
- Cultural obstacles
- Flow of communication

Desanctis and Monge, 1999
- Greater conflict between partners
- Decreased firm loyalty
- Higher probability of catastrophic events

Eschenbacher, et al., 2001
- Competence erosion
- Infrastructure costs/social costs
- Overtaxing/ costs for fluctuation
- Motivation factors such as security deficits / pseudo self employed
- Co-ordination issues such as culture erosion
- Technological diffusion barriers of the internet
- Legal diffusion barriers of the internet
- Contractual stipulations and disturbances

Fitzpatrick and Burke, 2000
- Loss of hands on control, reduced organizational participation, and weakened employee loyalty (Daft, 1991 in Fitzpatrick and Burke, 2000)
- Significant transshipment costs
- Counterintelligence problems / partner access to information (Nugent, 1992, and Galbraith, 1995 in Fitzpatrick and Burke, 2000)

Hardwick, et al., 1996
- Application systems cannot interoperate
- Loss of control of a project

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- Insufficient security controls
- Unfamiliar technologies and application systems

O'Hara-Devereaux and Johansen, 1994 (in Jarvenpaa and Leidner, 1999)
- Low individual commitment
- Role overload
- Role ambiquity
- Absenteeism
- Social loafing

Mowshowitz, 1997 (in Jarvenpaa and Leidner, 1999)
- Customers might perceive a lack of permanency in virtual forms
- Customers might perceive a lack of reliability in virtual forms
- Customers might perceive a lack of consistency in virtual forms

Strader, et al., 1998
- Potential for loss of control (outsourced functions, proprietary information, and technology)
- Must learn to trust outsiders
- Managers must learn to manage beyond their own walls
- Must adapt performance evaluation and compensation systems
- Need for coordination of business processes, personnel, and informations systems among partner firms

APPENDIX C

RESEARCH NEEDS IDENTIFIED IN THE LITERATURE

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- Ahonen, et al., refer to Bloch and Pigneur (1995) and "state that creating interorganizational information technology systems is one of the difficulties encountered at the startup of a virtual enterprise process." [Ahonen, et al., 2001]

- "Advances in communication technologies have enabled organizations to acquire and retain such distributed structures by supporting coordination among people working from different locations. Despite the rapid increase in the number of organizations that are becoming distributed, little is known about the structure or performance of such organizations." [Ahuja and Carley, 1999]

- "This study tests the impact of task-structure fit on effectiveness of virtual organizations. By building on this study, researchers can begin to address some of the issues related to virtual organizations and increase their effectiveness and performance....A second avenue for future research is to explore other determinants of objective performance in virtual organizations. Some possible determinants of virtual organization performance may include group size, level of communication, type of information being exchanged, and communication patterns and behaviors. Also, mechanisms for reducing information loss and retaining organizational memory in the face of fluidity need to be explored." [Ahuja and Carley, 1999]

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- "The virtual enterprise expands workflow well beyond the corporate walls. This wide-area workflow necessitates integrating decision support and business intelligence systems." [Biggs, 2000]

- In referring to virtual workplaces---"By far the biggest challenge is performance management, which requires that managers do three things well: define, facilitate, and encourage performance." [Cascio, 2000]

- "There is no common model for configuration management. That is, there are no standards with common objects and common functions. Further, no standard has considered configuration management for virtual enterprises, that is enterprises of the future." [Choi and Bae, 2001]

- "Currently, there is no formalized road map for establishing a virtual enterprise, and trial and error in an environment of rapidly evolving technology means that organizations take on a significant amount of risk when building a virtual enterprise." [Kernohan, 1999] Cooper and Muench describe the creation process to that of trying a new recipe. While the cook may have a good understanding of the ingredients and an idea about the process, it will take adjustments over time to perfect the ideas. [Cooper and Muench, 2000]

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- "There is a great need for research that isolates the task conditions that are most effective in virtual settings as well as the kinds of contractual arrangements that work best with a given type of task." [DeSanctis and Monge, 1999]

- "It is surprising that very little empirical research exists on virtual organizations. Especially lacking are studies of communication processes within virtual organization settings." [DeSanctis and Monge, 1999]

- "In addition to uncovering relationships among technology, structure, and communication, researchers should direct attention to specifying and evaluating strategies for organizational members. Possibilities include embedding procedural templates for communication into electronic media [Winograd and Flores, 1986], goal setting and specification of desired norms for communication [Marshall and Novick, 1995], or use of mediators to facilitate users' interaction with technology and to alter contexts of use [Orlikowski and Robey, 1991]. Finally, given the emphasis placed on trust, cohesion, and identity in virtual forms, team-building interventions may help organizations to manage communication and build mutual understanding among virtual participants." [DeSanctis and Monge, 1999]

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- "Bringing together the different partners and managing them is seen as being one of the biggest challenges of the virtual enterprise. Therefore some partners will have to focus on those managing tasks. It might as well be their responsibility to ensure that no legal conflicts in regard to the foundation, dissolving, production and related topics emerge. This being especially difficult because the efficiency of a virtual enterprise is strongly dependent on the looseness of its structure." [Eschenbacher, et al., 2001]

- "The problem of obligations describes one of the most controversial characteristics of Virtual enterprises and has been discussed insufficiently [Eschenbacher, et al., 2001—referring to Picot, 1996]

- "The advantages of virtual enterprises are especially valid for enterprises in the service sector. Furthermore this is a reason for most pilot projects taking place in the service sector. The validity of this statement has to be proven empirically in the near future, while today there are no investigations available which focus on a quantitative analysis of virtual enterprise network areas. A central problem of further empirical analysis will be the differentiation of virtual enterprises in qualitative terms." [Eschenbacher, et al., 2001]

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- "With the idea of virtual enterprises gaining acceptance and earning its first merits in commercial practice it is to be expected that a common structure for this kind of co-operation will be established. This common structure might be subject to a more thorough investigation." [Eschenbacher, et al., 2001]

- "An adjustable legal structure would mean the development of common terms and conditions for virtual enterprises." [Eschenbacher, et al., 2001]

- "It is expected that lawyers will soon provide model contracts for various forms of Virtual enterprises all of which may easily be adopted to every special task." [Eschenbacher, et al., 2001]

- Building a Code of Business Ethics for Virtual Organizations---could be key for developing trust. [Kasper-Fuehrer and Ashkanasy, 2001]

- "Different forms of trust have been identified in the literature, however, such as calculative trust, authentic trust, and ethics-based trust. Clearly, there is scope for future research to examine differential effects in the context of virtual organizations across the different types of trust." [Kasper-Fuehrer and Ashkanasy, 2001]

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- "In respect of the role of ICT (Information and Communication Technology) in facilitating communication of trustworthiness, we have proposed that system stability and bandwidth, as well as features that communicate emotion are important. Other more fundamental aspects concerning the nature of trust, however, such as deep versus shallow system structure and different forms of trust, have implications for the manner in which trustworthiness is communicated, and provide additional areas for future research." [Kasper-Fuehrer and Ashkanasy, 2001]

- "To date…little is known of the means by which members of virtual organizations communicate their shared values and visions, and the idea of a transmutable organizational identity is new and has not been empirically validated. Clearly, this too remains an area in need of further research." [Kasper-Fuehrer and Ashkanasy, 2001]

- "Wicks et al. [1999] …have argued that there is an optimal level of trust in business transactions, governed by the need for to take appropriate safeguards against trust violations. In the case of virtual organizations, where their temporary nature mitigates against establishing deep levels of trust, there is therefore scope for research to see if an appropriate situation-contingent level of optimal trust can be determined." [Kasper-Fuehrer and Ashkanasy, 2001]

- "Clearly these interactions (of common business understanding, role of ICT, and establishment and recognition of mutual ethical practices---factors felt to contribute to trust) also present some exciting possibilities for future research into trust building in virtual organizations." [Kasper-Fuehrer and Ashkanasy, 2001]

- "A new problem arises for the manager of an extended enterprise, how to share the tasks among the different resources to execute the order book." [Lecompte, et al., 2000]

- "Note that we do not search the automation of the decision support system for the decision-maker. The decision support panel module provides the human decision-maker with the following: - The resource capacity indicator: the maximal number of concrete operations the resource can simultaneously perform. – The resource availability indicator: the amount of work that can be allocated to the resource." [Lecompte, et al., 2000]

- "The issue of managing remote workers in virtual organizations is critical and needs to be better understood. As Lucas [1996] notes, with rapid growth in virtual organizations, research is clearly needed on what organizations and

managers can do to make their remote employees more effective." [Staples, et al., 1999]

- "A wide range of decision processes must be supported to enable effective virtual organization management throughout the organization's life cycle. Because of this, the decision processes must be supported by an information infrastructure that enables the required information to be available to management quickly and accurately." [Strader, et al., 1998]

- "Another big problem is location. People can be located on different continents and can have different schedules. Obtaining a mutual agreement on the fly can take a lot of time. Some decisions need synchronous interaction (e.g. a phone conversations) and this imposes more constraints on the decision taking process. It is obvious that for this kind of manufacturing control, people can benefit from a distributed decision support system." [Wortmann and Szirbik, 2001]

- "Production planning and control plays an important role in running a virtual enterprise and has a major potential to improve its performance….Inaccurate data has been identified as the main reason for failure when implementing production planning and control systems. This situation will become worse in a virtual

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enterprise environment, which is characterized by distribution, autonomy and

cooperation." [Zhou, et al., 2000]

APPENDIX D

DEFINITIONS OF VIRTUAL ENTERPRISES

Given below are samples of the many definitions in the literature on virtual enterprises. Other common synonyms include virtual organizations, virtual corporations, and network organizations.

- "A virtual enterprise is a temporary consortium of independent enterprises and/or individuals (service providers, clients) connected via modern telecommunication networks and with the objective of sharing abilities, costs, resources and knowledge." [Ahonen, et al., 2001]

- A virtual organization is "a geographically distributed organization whose members are bound by a long-term common interest or goal, and who communicate and coordinate their work through information technology." [Ahuja and Carley, 1999]

- A virtual enterprise is "an organization form in which a collection of legally independent enterprises, institutions, or single persons come together quickly to cooperate for a particular mission." [Arnold, et.al., 1995 in Kanet and Faisst, 1999]

- A virtual corporation is "a temporary network of independent companies, suppliers, customers, even erstwhile rivals—linked by information technology to share skills, cost and access to one another's markets" [Byrne and Brandt, 1993]

- A virtual enterprise is "a temporary alliance of enterprises that come together to share skills and resources in order to better respond to business opportunities and whose cooperation is supported by computer networks." [Camarinha-Matos, et al., 2001]

- "At a macro level, a virtual organization consists of a grouping of businesses, consultants, and contractors that have joined in an alliance to exploit complementary skills in pursuing common strategic objectives. The objectives often focus on a specific project." [Cascio, 2000]

- "A virtual enterprise (VE) is a temporary organization of companies that come together to share costs and skills to address business opportunities that they could not undertake individually." [Choi and Bae, 2001---referring to National Industrial Information Infrastructure Protocols (NIIIP), 1998]

- "A virtual corporation is a temporary network or loose coalition of manufacturing and administrative services that comes together for a specific business purpose and then disassembles when the purpose has been met." [Christie, et al., 1998]

- "A virtual organization is a collection of geographically distributed, functionally and/or culturally diverse entities that are linked by electronic forms of communication and rely on lateral, dynamic relationships for coordination." [DeSanctis and Monge, 1999]

- "The extended enterprise consists of a network of existing companies co-operating for certain operations or projects. In reality it is an organizational group, more precise a network of legally independent, economically more or less dependent companies with the purpose to co-operate in specific projects by using information and communication technology." [Eschenbacher, et al., 2001--- referring to Klein, 1994]

- "A virtual organization is one to which different people contribute, from the strategic apex to the operational level, and do no necessarily coincide on time or space." [Gil-Estallo, et al., 2000]

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- A virtual organization is "a temporary network organization, consisting of independent enterprises (organizations, companies, institutions, or specialized individuals) that come together swiftly to exploit an apparent market opportunity. The enterprises utilize their core competencies in an attempt to create a best-of-everything organization in a Value-Adding Partnership (VAP), facilitated by Information and Communication Technology (ICT). As such, virtual organizations act in all appearances as a single organizational unit." [Fuehrer and Ashkanasy, 1998]

- "A virtual enterprise is the co-operation of independently operating enterprises with the aim to design, build and sell specific products." [Furst and Schmidt, 2001]

- "A virtual enterprise is a group of business partners who have agreed to extend the walls of their own organizations to collaborate and engage in commerce with each other via e-business technologies." [Kernohan, 1999]

- "Virtual enterprises are generally defined as a way of organizing business activities, where different and independent partners exploit business opportunity by establishing an enterprise cooperation." [Lau and Wong, 2001---referring to Davidow and Malone, 1993 #1]

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- "Virtual enterprise has been noted as a subset of the virtual organization (VO), which is an alliance of firms that are the potential partners for future cooperation and/or joint ventures for a particular sector of industry and/or from a particular economy." [Lau and Wong, 2001---referring to Goldman, et al., 1995]

- "Virtual organizations are continuously evolving networks of independent companies linked together to share skills, costs, and access to one another's markets and data. These ad hoc alliances are short-lived, extremely focused, goal-driven, and powered by time-based competition." [Levary, 2000]

- "Virtual organizations can take many forms but in general they are made up of temporary teams of employees and nonemployees who are brought together for the duration of a specific project. They often contribute their work from remote locations and are then disbanded." [Anonymous, February 2001]

- "A virtual enterprise is a temporary consortium formed by real autonomous companies on the basis of strong collaboration to exploit fast-changing worldwide opportunities quickly, which a single company is unlikely to realize. It is assembled based on cost-effectiveness and production competencies with less regard for organizations, geographic locations, computing environments or

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technologies deployed. That is to say, it is virtual in organization, location and

technology." [Zhou, et al., 2000]

APPENDIX E

WORK BREAKDOWN STRUCTURE DICTIONARY FOR

VIRTUAL ENTERPRISE CREATION

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Activity Definition (01-01-2021)- the process of determining the specific elements of work that make-up a project

Activity Duration Estimates (01-01-2023)- an approximation of the length of time that an element of work will take to complete

Activity Sequence (01-01-2022)- a description of the order in which the tasks of a virtual enterprise must be completed

Completion Time (01-01-2052)- the required date for which an activity must be completed

Contract (01-03)- a document that formally states the agreements between two or more parties

Contractual Relations (01-01-206)- the preferred type of contractual arrangement for partnering with an organization; preferred contractual relations are usually identified in a request for proposal

Cost Analysis (01-01-301)- an examination of the proposed costs for completing a task

Cost Estimates (01-01-2053)- approximations of the economic restrictions for completing a task

Cost and Schedule Constraints (01-01-206)- economic and time limitations/restrictions that are placed upon a system

Equipment (01-01-2032)- assets that are utilized to accomplish a task; equipment is usually moveable

Feasibility Study (01-01)- the process of investigating a problem and developing a solution in enough detail to determine if fully addressing the problem is economical

Human Skills (01-01-2031)- the abilities or proficiencies provided by a person

Information Technology (01-01-2033)- computer systems and applications (both hardware and software) that are utilized for communication, collaboration, and access to information

Materials (01-01-2041)- the substance(s) out of which something is made

Objective (01-01-201)- the purpose for a virtual partnership; the task that will be accomplished by a virtual partner

Offer (01-02-400)- an invitation to become a partner in the virtual enterprise; offers are formally accepted through the signing of a contract

Partner Factor Evaluations (01-02-200)- an assessment of how well a potential partner's characteristics to determine the degree to which a positive and successful relationship will occur

Partner Selection (01-02)- the process of evaluating and selecting organizations to become members of a virtual enterprise

Performance Analysis (01-01-302)- an examination of the abilities of a contractor to meet specified requirements

Performance Specifications (01-01-204)- a documentation of the various types of requirements placed upon a system

Preliminary Study (01-01-100)- a brief, preliminary investigation to determine that an idea has merit and has a reasonable degree of success; preliminary studies are not as detailed as feasibility studies

Project Scope (01-01-202)- the breadth of activities to be addressed; the boundaries placed on what a project will achieve

Proposal Review (01-01-300)- the process of evaluating proposals in order to determine feasibility and to judge between competing alternatives

Quantitative Evaluations (01-02-300)- an assessment technique that determines a score for a potential partner's ability to meet specified requirements

Request for Proposal (01-01-200)- a document used to solicit work; it outlines a need and requirements of the party soliciting the work

Resources (01-01-203)- people, places, or things that are utilized to accomplish a task

Work Duration (01-01-2051)- an approximation for the length of time available to complete a task

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Task Factor Evaluations (01-02-100)- an assessment of how well a potential partner's characteristics relate to the specific task that they will perform

Tolerances (01-01-2042)- the permissible leeway from a standard

Virtual Enterprise Creation (01)- the task of forming a virtual enterprise; the tasks range from determining a need and the feasibility of addressing it to contracting with partners

APPENDIX F

IDEF0 DICTIONARY

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Applied Theories: the basic foundational theories of motivation that relate to and are used for a particular situation.

Available Data/Information: any records, statistics, facts, etc. that is needed by and provided for parties within the virtual enterprise.

Collaboration Media: methods of communicating dynamically so that each piece of information builds upon the other such that progress toward a goal is accomplished.

Communication Channels: methods of interaction that allow two or more parties to exchange information.

Compatibility Elements: factors to consider during a pre-partner cultural assessment that may influence the degree to which relationships are congruent. See Table 11.4 and Figure 11.8.

Concluding Analyses: final assessments of potential partners that are used to confirm matters previously discussed or to clarify any unknowns. These assessments often include site visits, follow-up interviews, and total cost evaluations.

Contractual Relationships: formal and legal agreements between parties to do something.

Cultural Evaluations: assessments that consider the degree to which a partnership will have a congruent relationship. In performing the assessment, certain compatibility elements are often considered. Examples of the elements may be found in Table 11.4 and Figure 11.8.

Cultural Factors: aspects that, in sum, denote the central values and beliefs of an organization. See Figure 11.12.

Daily Actions: the day-to-day exhibited behaviors of the members of the virtual enterprise.

Data Access Needs: the necessity of a party of the virtual enterprise to gain access to information, statistics, facts, etc.

Desired Behaviors: the preferred actions/outcomes of the virtual enterprise and its members.

Expectations: a set of ideas on how the virtual enterprise will operate in order to achieve its vision and mission.

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Expected Culture: the mutual values, goals, and management approaches and procedures common to all members of the virtual enterprise that are desired by the virtual enterprise's leadership.

Factors of Cooperative Natures: aspects that influence the character of something to desire the achievement of team ambitions. See Figure 11.18.

Hands-on Leadership: a type of management that is denoted by personal attention and actions that reinforce ideas.

Incentives and Control Systems: a process that is used to compel behaviors to conform to the objectives of the virtual enterprise.

Initial Factors of Trust: things that influence the confidence one party has for another prior to partnership decisions as well as in the early stages of the virtual enterprise. See Figure 11.16.

Interests: things that appeal to the individuals of the virtual enterprise; discussing these interests helps develop communication between parties and relationships.

Internal Marketing Concepts: ideas that promote the need for each member of the organization as well as the advantages that result from the virtual structure. See Table 11.11 and Section 10.4.

Leadership: a group of people in the virtual enterprise that possess the power to guide as well as influence commitment, motivation, and trust.

Leadership Elements: key factors that influence the degree to which one has the power to influence the development of a virtual enterprise's culture. See Figure 11.13.

Leadership Qualities: characteristics of those who possess the power to guide as well as influence commitment, motivation, and trust. See Figure 11.20.

Life Cycle Phase: a distinct stage in the progression of the virtual enterprise. Typical stages include identification, formation, operation, and termination.

Materials: physical items used in the development of a product or accomplishment of a task.

More Compatible Culture: the development of a like-minded set of mutual values, goals, and management approaches and procedures.

Objectives: goals that the virtual enterprise is striving to achieve.

Ownership: a personal stake in the accomplishment of some objective.

Partners: the network of companies that encompass the virtual enterprise.

Partners' Cultures: the mutual values, goals, and management approaches and procedures common to those within a particular company that is a partner of the virtual enterprise.

Partner (Ta^0, C^0, Tr^0): an attribute denoting how well a potential partner scores in terms of the following: task related factors, cultural related factors, and trust. These scores are null (---) if the broker has no prior knowledge of the potential partner.

Partner (Ta^1, C^0, Tr^1): an attribute denoting how well a potential partner scores in terms of the following: task related factors, cultural related factors, and trust. These scores are determined after task related factors have been evaluated.

Partner (Ta^1, C^1, Tr^2): an attribute denoting how well a potential partner scores in terms of the following: task related factors, cultural related factors, and trust. These scores are determined after both task and culture related factors have been evaluated.

Partner (Ta^1, C^1, Tr^3, Q^0): an attribute denoting how well a potential partner scores in terms of the following: task related factors, cultural related factors, trust, and a quantitative assessment. These scores are determined after both task and culture related factors have been evaluated and after a quantitative analysis of the partner is performed.

Partner (Ta^1, C^1, Tr^4, Q^0): an attribute denoting how well a potential partner scores in terms of the following: task related factors, cultural related factors, trust, and a quantitative assessment. These scores are determined after task and culture related factors have been evaluated, after a quantitative analysis of the partner is performed, and after an assessment of trust levels has occurred in the early stages of the virtual enterprise.

Partner (Ta^1, C^1, Tr^5, Q^0): an attribute denoting how well a potential partner scores in terms of the following: task related factors, cultural related factors, trust, and a quantitative assessment. These scores are determined after task and culture related factors have been evaluated, after a quantitative analysis of the partner is performed, after

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an assessment of trust levels has occurred in the early stages of the virtual enterprise, and after key trust development activities have been performed.

Potential Benefits: any possible advantage that might occur as a result of being a contributing member of a virtual enterprise.

Potential Partners: companies that will possibly become members of the virtual enterprise.

Potential Partners' Cultures: the mutual values, goals, and management approaches and procedures common to those within a particular company that will possibly become a partner of the virtual enterprise.

Precedence Relationships: an ordering of tasks where tasks' initializations are dependent upon the completion of other tasks.

Quantitative Comparison Methodology: a technique for evaluating potential future partners based on a predetermined set of categories. The scores generated are used to rank the potential partners. See Figure 11.9 and Tables 11.6 - 11.8.

Relationship Development Factors: aspects that promote a bond or rapport between parties. See Figure 11.17.

Resources: things the virtual enterprise can draw upon to accomplish its tasks.

Responsibilities: the duties or tasks one is responsible for in order to accomplish the objectives of the virtual enterprise.

Selected Employees- workers of the virtual enterprise that are chosen for leadership positions.

Strategy: a plan for achieving the objectives of the virtual enterprise.

Task Behavior: outcomes associated with the accomplishment (or no accomplishment) of the activities of the virtual enterprise.

Task Capability Evaluations: assessments that consider a potential partner's ability to perform the necessary actions within the virtual enterprise.

Task Guidelines: a course of action or procedure for performing an undertaking.

Time-Phased Plan: actions within the virtual enterprise that are well arranged in order to develop the most optimal schedule of events.

Traditional Theories: basic foundations that explain what motivates a person. See Section 10.2.

Values: a set of standards or principles by which the virtual enterprise desires to operate.

Virtual Enterprise Environment: conditions and circumstances (whether political, social, or cultural) that are associated with accomplishing the tasks of the virtual enterprise.

Virtual Enterprise Mission: the ultimate goal of the virtual enterprise.

Virtual Enterprise Needs: something required to accomplish a particular task in the virtual enterprise.

Virtual Enterprise Tasks: the works necessary to accomplish the objective(s) of the virtual enterprise.

Virtual Enterprise Vision: an idea about the future of the virtual enterprise that is used as a way to energize and motivate the members to achieve the desired future state.